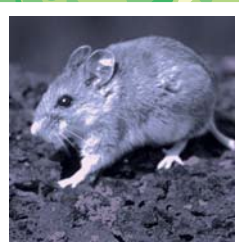


Vector-Borne Diseases in California

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ANNUAL
REPORT**



**Vector-Borne Disease Section
California Department of Health Services
August 2005**

2004

ANNUAL REPORT

VECTOR-BORNE DISEASE SECTION

INFECTIOUS DISEASES BRANCH

DIVISION OF COMMUNICABLE DISEASE CONTROL

CALIFORNIA DEPARTMENT OF HEALTH SERVICES



Arnold Schwarzenegger
Governor
State of California

Kimberly Belshé, Secretary
Health and Human Services Agency

Sandra Shewry, Director
Department of Health Services

2004
ANNUAL REPORT
VECTOR-BORNE DISEASE SECTION

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Rodent-borne disease surveillance

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Plague surveillance

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Tick-borne Disease Surveillance

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SANDRA SHEWRY
Director

State of California-Health and Human Services Agency
Department of Health Services



ARNOLD SCHWARZENEGGER
Governor

I am pleased to submit to you the 2004 Annual Report for the Vector-Borne Disease Section (VBDS) of the California Department of Health Services. VBDS staff conducted surveillance, prevention, and control of existing and emerging vector-borne diseases throughout California in 2004.

West Nile virus (WNV) spread from six southern California counties in 2003 to all 58 California counties in 2004. There were 830 human WNV infections; 28 people died. Nationally, there were 2,535 human cases, with the highest number of cases reported from California. WNV also had a significant impact on wildlife and horses in California; the virus was detected in 92 species of birds and 42 percent of the 540 WNV horse cases were fatal. VBDS worked closely with other DHS programs and state and local agencies to respond to the WNV epidemic, which constituted the largest outbreak of arboviral disease ever documented in California. Surveillance, prevention, and control activities were enhanced statewide, including the streamlining of diagnostic procedures and reporting, expansion of public education materials, the website <http://westnile.ca.gov>, and hotline, and development of contingency plans for "large-scale" emergency mosquito control. VBDS staff worked "around the clock" to minimize the risk of WNV transmission to people throughout the state.

VBDS completed the fifth year of a contract project with Caltrans to evaluate mosquito production in stormwater treatment devices. In 2004, VBDS expanded the size and scope of the projects in the Lake Tahoe region and began to monitor a new series of pilot sites in Orange County.

Our biologists conducted numerous plague surveys at recreational areas in California and investigated three human cases of hantavirus pulmonary syndrome. Long-term studies on the ecology of hantavirus entered their third year in Plumas and Eldorado National Forests. One of our California Epidemiologic Investigation Service (Cal-EIS) Fellows initiated a year-long project to evaluate the risk of hantavirus transmission to employees at U.S. Forest Service facilities throughout California. The Fellow and VBDS Biologists evaluated and made recommendations for risk mitigation at 13 facilities in six National Forests.

VBDS investigated several cases of rare tick-borne diseases in the San Francisco Bay Area, including tularemia, Rocky Mountain spotted fever, and anaplasmosis. We enhanced our tick-borne disease education program through development and distribution of public service announcements, prevention posters, and tick identification cards.

Many of you are our collaborators and colleagues and I hope that you find the information contained in this annual report to be of value as we collectively strive to promote and protect the health of all Californians.

Respectfully,

Vicki L. Kramer, Ph.D., Chief
Vector-Borne Disease Section

Introduction

The mission of the California Department of Health Services Vector-Borne Disease Section (VBDS) is to protect the health and well-being of Californians from insect- and vertebrate-transmitted diseases and injurious pests. VBDS provides leadership, information, and consultation on vector-borne diseases to the general public and agencies engaged in vector control activities.

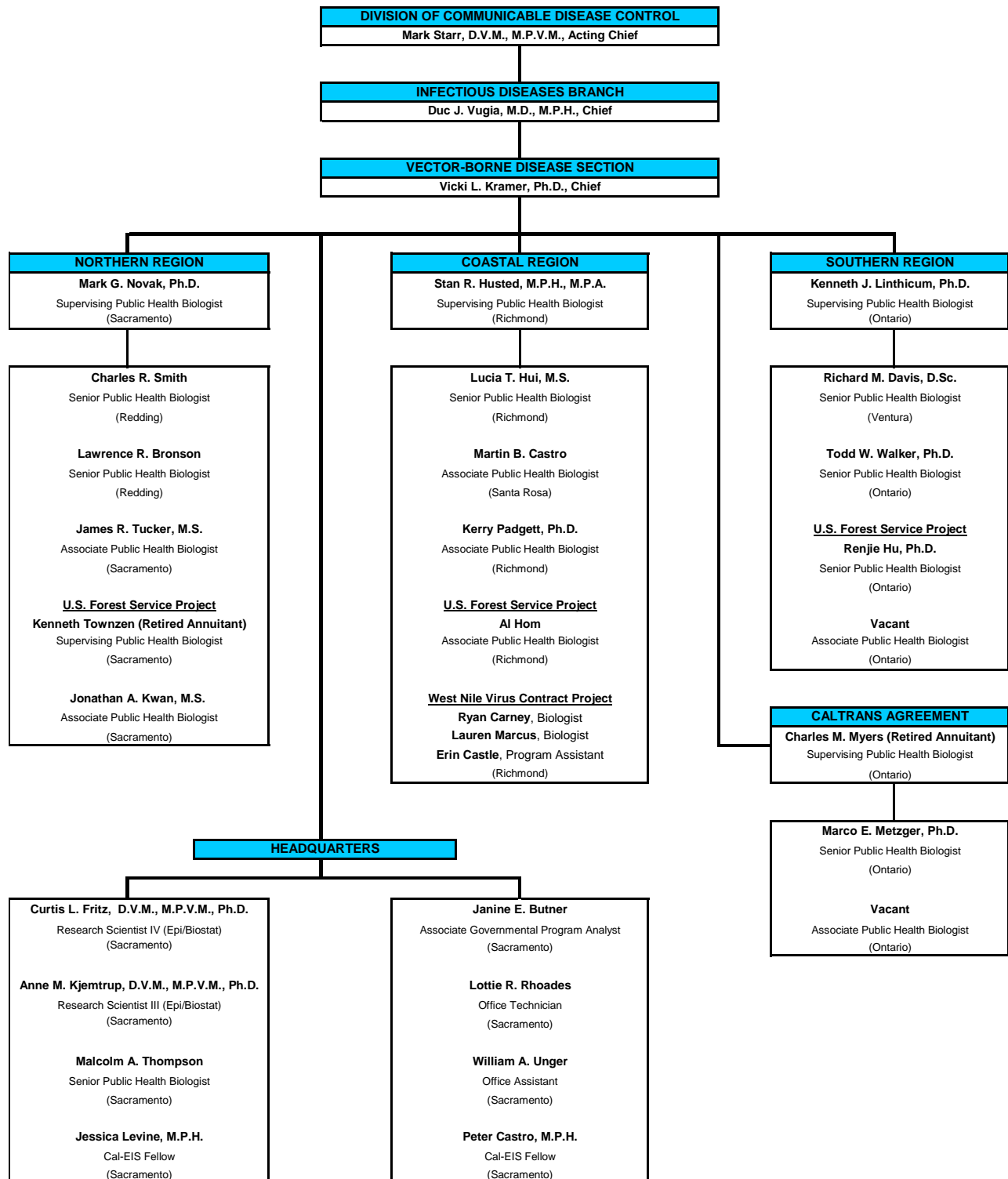
VBDS staff, located in six regional offices and headquartered in Sacramento, provide the following services:

- Develop and implement statewide vector-borne disease surveillance, prevention, and control programs
- Design and conduct scientific investigations to further knowledge of vector-borne diseases in California
- Coordinate preparedness activities for detection and response to introduced vectors and vector-borne diseases, such as West Nile virus
- Conduct emergency vector control when disease outbreaks occur
- Administer public health exemptions in disease outbreaks where applicable under the Endangered Species Act
- Advise local agencies on public health issues related to vector-borne diseases
- Oversee local vector control agency activities through a Cooperative Agreement
- Oversee the Vector Control Technician Certification and Continuing Education programs
- Provide information, training, and educational materials to governmental agencies and the public
- Provide assistance in coordinating issues related to the management of Africanized honey bees and red imported fire ants
- Advise local governmental agencies, schools, and the public on head lice management
- Maintain the San Francisco Bay Area U.S. Army Corps of Engineers general permit, which allows local vector control agencies to conduct abatement activities
- Oversee Special Local Need permits on restricted use of public health pesticides

This report summarizes surveillance and control activities for plague, hantavirus pulmonary syndrome, and mosquito- and tick-borne diseases in 2004. Activities conducted in the National Forests of California to protect United States Forest Service (USFS) personnel and visitors from vector-borne diseases are included in this report; USFS provides support for these activities through a cost-share agreement. Results from a special project with the California Department of Transportation to examine vector production in stormwater treatment devices are described. VBDS oversees the Vector Control Technician Certification Program; data summarizing the number of exams administered by VBDS and the number of vector control technicians in each certification category are provided. As education and training are important components of a vector-borne disease prevention program, a summary of the many presentations and reports prepared by VBDS staff is included. Many of the state and local agencies with which VBDS collaborated in 2004 are listed in the Acknowledgements section.

Authorizing statutes include: Health and Safety (H&S) Code 116108-116120; H&S Code 116102, et. seq.; H&S Code 116180; Gov. Code 12582

Personnel



Rodent-borne Virus Surveillance

Hantavirus pulmonary syndrome in California residents

Three cases of hantavirus pulmonary syndrome (HPS) were identified in California residents during 2004. Investigations of these cases by the California Department of Health Services (CDHS) and collaborating agencies are summarized below.

San Diego County, May 2004

A 32-year-old woman developed fever, fatigue, and progressive respiratory difficulty in late May. Thoracic radiographs taken approximately one week after onset revealed interstitial infiltrates. The patient recovered following 12 days in hospital. Acute serum specimens sent to a commercial laboratory were reported as positive for hantavirus antibody. The CDHS Viral and Rickettsial Disease Laboratory (VRDL) confirmed the presence of IgM and IgG antibodies to Sin Nombre virus (SNV) in both reserved acute serum and a convalescent specimen collected approximately three weeks after onset.

The San Diego County Health and Human Services Agency interviewed the case-patient, her family, and friends regarding potential exposure activities. The case-patient reported no travel outside San Diego County in the weeks preceding her illness. Three sites in southern San Diego County, including the case-patient's residence, were identified as possible exposure sites. The San Diego County Vector Control Program inspected these sites and collected 15 rodents. The VRDL reported detecting serum antibodies to SNV in three of nine *Peromyscus maniculatus* from one site. The VRDL also detected SNV RNA by polymerase chain reaction (PCR) in the three seropositive mice and one seronegative mouse from the same site.

Plumas County, June 2004

A 23-year-old man had onset of illness in late June. He had a relatively mild clinical course and recovered following one week of hospitalization. Both the Nevada State Public Health Laboratory and the CDHS VRDL reported detecting IgM and IgG antibodies to SNV in an acute serum specimen. The case-patient lived and worked at a university field research station in Plumas County. He was employed as one of a team of biologists to conduct rodent collection for a university-funded project. Staff from the CDHS Vector-Borne Disease Section (VBDS) and Plumas County Departments of Health and Environmental Health visited the sites in July and observed evidence of rodent infestation in the living quarters and surrounding areas. The study's collection and handling protocols were noted to be deficient in measures necessary to protect workers from hantavirus exposure. Fifty *P. maniculatus* were collected from the residential and study areas. The VRDL detected antibodies to SNV in sera from 16 (30%) mice. VBDS staff provided the researchers with recommendations for rodent control and exclusion from the buildings, as well as training in proper techniques for rodent collection and handling.

Nevada County, August 2004

A 65-year-old man presented to a local hospital in August with a four-day history of flu-like symptoms. Pulmonary infiltrates were evident on thoracic radiographs obtained at admission. The patient experienced mild respiratory compromise and was provided supplemental oxygen. The patient recovered and was discharged. A commercial diagnostic laboratory reported detecting IgM and IgG antibodies to hantavirus in a serum specimen collected on the day of discharge. The CDHS VRDL confirmed the presence of IgM antibodies to SNV in an aliquot of the acute specimen. The patient reported no travel or known rodent contact. Based on interviews with the case-patient and absence of any recent significant travel, it was determined that the individual was most likely exposed in or around his home. The patient reported working on the

plumbing of a spa on a wooden deck in the days preceding his illness. Evaluation of the case-patient's residence in September by CDHS VBDS revealed abundant harborage (e.g., firewood stacked against the side of the house) and access points for rodents. Rodent feces were noted in the poorly ventilated utility room. Six *P. maniculatus* were collected from both outside and inside the building. Serum antibodies to SNV were detected in one mouse from the utility room. The case-patient was informed of the results and provided recommendations for proper rodent elimination, exclusion, and cleanup.

Since 1993, HPS has been diagnosed in 43 California residents. Four of these were identified retrospectively, with onset of illness having occurred in 1980, 1984, and 1992 (2). An additional two California residents were diagnosed with acute SNV infection without pulmonary manifestations. The median age of all 45 case-patients was 41 years (range, 12 to 74) and 26 were male. Case-patients were residents of 19 counties: Alameda, Alpine, Contra Costa (2), Inyo (6), Kern (4), Los Angeles (2), Modoc, Mono (9), Nevada (3), Plumas (2), Sacramento, Santa Barbara (2), San Bernardino, San Diego, San Francisco, Santa Clara (2), Sierra, Ventura (2), and Yolo (2). Probable and possible sites of exposure included the counties of Alameda, Alpine (2), Fresno, Inyo (7), Kern (4), Modoc, Mono (11), Nevada (3), Placer, Plumas (2), San Bernardino, San Diego, Santa Barbara, Sierra, and Tuolumne, and the states of Arizona, New Mexico (3), Utah, and Washington. Fifteen (33%) cases had a fatal outcome.

Surveillance for hantavirus in California rodents

In 2004, 2,429 rodents were collected and serologically tested for SNV antibody, representing at least 17 species from eight genera (Table 1). At least one seroreactive rodent was detected in 12 of 16 California counties in which surveillance was conducted in 2004. Of 1,879 *Peromyscus* spp. collected, 229 (12.2 %) had serologic evidence of infection with SNV. Seroprevalence was highest in *Peromyscus maniculatus* at 15.9 percent. Active surveillance since 1993 and retrospective analysis of rodent specimens captured since 1975 have identified serologic evidence of SNV infection in 13.1 percent of *P. maniculatus* statewide. At least one seroreactive *P. maniculatus* specimen has been identified in 44 of 54 counties sampled (Table 2).

Reithrodontomys megalotis and *Microtus californicus* specimens have demonstrated evidence of infection with Sin Nombre-like hantaviruses (El Moro Canyon and Isla Vista, respectively), but these strain variants have not been shown to be pathogenic to humans. Seroreactivity has been occasionally identified in *Neotoma*, *Chaetodipus*, and *Spermophilus* rodents in California and elsewhere; however, it is believed that these species are incidentally infected with SNV and are not competent reservoirs or vectors.

Plumas National Forest study

VBDS completed the fifth year of a multi-year study to describe the dynamics of rodents and hantavirus infection in northern California. In September 2000, VBDS initiated routine rodent collection and serologic testing at a U.S. Forest Service fire station in Plumas National Forest, Lassen County. Seven lines of 25 traps each were established, encompassing four habitats: altered oak woodland, dry hillside, riparian, and in and around buildings. In 2004, 629 rodents were trapped over seven pairs of trap nights between April and November. Total rodent captures ranged from 53 in April to 133 in November, with the majority of rodents being *P. boylii* in July/August and *P. maniculatus* in November. The VRDL detected SNV antibodies in 34 of 438 serum samples: 7 (3.3%) of 209 *P. boylii* and 27 (13.4%) of 202 *P. maniculatus*. Antibody prevalence ranged from 3.9 percent (May) to 12.1 percent (November). Sixteen (12.4%) positive serum specimens were from 129 rodents captured in or around structures at the facility. VBDS forwarded surveillance results to USFS personnel and provided recommendations for continued rodent exclusion and removal efforts.

Eldorado National Forest study

As a companion study to the Plumas National Forest study, VBDS initiated surveillance for hantavirus in rodents at two sites—a fire station and a fire lookout—in Eldorado National Forest in 2002. Both sites harbor robust populations of deer mice (*P. maniculatus*). In 2004, surveillance was conducted over four trap nights between May and September at the fire station, and three trap nights between July and September at the lookout. One hundred Sherman traps placed around the fire station and fifty set at the lookout captured a total of 168 deer mice and 7 long-tailed voles (*Microtus longicaudus*). All rodents were ear-tagged, sampled, and released. Of 92 deer mice at the fire station and 76 at the lookout, 23 (25%) and 26 (34%), respectively, had detectable antibodies to SNV. Antibody prevalence in the deer mice ranged from 12.5% to 39% at the fire station and from 16% to 45% at the lookout. All voles tested negative.

U.S. Forest Service hantavirus risk assessment

Staff of VBDS and the CDHS California Epidemiologic Investigation Service (Cal-EIS) initiated a year-long project to evaluate factors associated with maintenance and transmission of hantavirus at facilities maintained and occupied by the U.S. Forest Service (USFS) in California. Variables evaluated included (1) person-time exposure; (2) employee training and education; (3) rodent opportunity, incentives, and activity; and (4) SNV activity based on rodent serology. Project sites were selected based on accessibility, Forest Service recommendations and requests, personnel density, and existing data. Data collected in 2004 are detailed in the USFS Activities section of this report (page 36).

Table 1. Serologic evidence of hantavirus (Sin Nombre) in California rodents, 1975-2004.

Species	Common name	2004			1975-2004		
		No. collected	No. reactive	Percent	No. collected	No. reactive	Percent
FAMILY MURIDAE							
SUBFAMILY SIGMODONTINAE							
<i>Neotoma fuscipes</i>	dusky-footed woodrat	38	0	0.0	897	10	1.1
<i>Neotoma lepida</i>	desert woodrat	39	0	0.0	642	21	3.3
<i>Neotoma</i> sp.	other and unspecified <i>Neotoma</i>				121	2	1.7
<i>Onychomys torridus</i>	southern grasshopper mouse				5	0	0.0
<i>Peromyscus boylii</i>	brush mouse	285	8	2.8	1899	75	3.9
<i>Peromyscus californicus</i>	parasitic mouse	93	1	1.1	1855	36	1.9
<i>Peromyscus crinitus</i>	canyon mouse	27	2	7.4	303	13	4.3
<i>Peromyscus eremicus</i>	cactus mouse	428	25	5.8	1595	80	5.0
<i>Peromyscus maniculatus</i>	deer mouse	1229	193	15.7	8486	1110	13.1
<i>Peromyscus truei</i>	piñon mouse	87	0	0.0	721	23	3.2
<i>Peromyscus</i> sp.	unspecified <i>Peromyscus</i>	2	0	0.0	158	15	9.5
<i>Reithrodontomys megalotis</i>	western harvest mouse	109	11	10.1	688	82	11.9
<i>Sigmodon hispidus</i>	hispid cotton rat				22	0	0.0
SUBFAMILY ARVICOLINAE							
<i>Clethrionomys californicus</i>	California red-backed vole				1	0	0.0
<i>Microtus californicus</i>	California vole	34	3	8.8	210	34	16.2
<i>Microtus</i> spp.	other and unspecified <i>Microtus</i>	9	1	11.1	58	6	10.3
SUBFAMILY MURINAE							
<i>Mus musculus</i>	house mouse	23	0	0.0	316	0	0.0
<i>Rattus</i> spp.	Norway rat and black rat	15	0	0.0	203	0	0.0
FAMILY HETEROMYIDAE							
<i>Chaetodipus</i> spp.	pocket mice	11	0	0.0	581	3	0.5
<i>Dipodomys</i> spp.	kangaroo rats				77	1	1.3
<i>Perognathus parvus</i>	Great Basin pocket mouse				18	1	5.6
FAMILY SCIURIDAE							
<i>Ammospermophilus leucurus</i>	white-tailed antelope squirrel				5	0	0.0
<i>Glaucomys sabrinus</i>	northern flying squirrel				1	0	0.0
<i>Sciurus griseus</i>	western gray squirrel				1	0	0.0
<i>Spermophilus</i> spp.	ground squirrels				1227	1	0.1
<i>Tamias</i> spp.	chipmunks				285	0	0.0
<i>Tamiasciurus douglasii</i>	Douglas squirrel				8	0	0.0

Source: California Department of Health Services

Table 2. Serologic evidence of hantavirus (Sin Nombre) infection in *Peromyscus maniculatus*, by county, 1975-2004.

County	2004			1975-2004		
	No. collected	No. reactive	Percent	No. collected	No. reactive	Percent
Alameda				92	2	2.2
Alpine	22	4	18.2	124	36	29.0
Butte				115	14	12.2
Calaveras	3	1	33.3	48	10	20.8
Colusa				23	9	39.1
Contra Costa				36	0	0.0
Del Norte				49	1	2.0
El Dorado	168	51	30.4	389	157	40.4
Fresno	14	0	0.0	522	75	14.4
Glenn				4	0	0.0
Humboldt				55	5	9.1
Imperial				6	1	16.7
Inyo				81	8	9.9
Kern				129	10	7.8
Lake				22	1	4.5
Lassen	253	37	14.6	573	95	16.6
Los Angeles	11	0	0.0	409	22	5.4
Madera				62	8	12.9
Marin				105	3	2.9
Mariposa				46	7	15.2
Mendocino				38	4	10.5
Merced				68	4	5.9
Modoc	13	0	0.0	84	10	11.9
Mono				273	58	21.2
Monterey				125	15	12.0
Napa	42	8	19.0	66	8	12.1
Nevada	23	7	30.4	173	59	34.1
Orange	186	13	7.0	766	48	6.3
Placer				32	2	6.3
Plumas	67	17	25.4	143	33	23.1
Riverside	265	40	15.1	1384	154	11.1
Sacramento				36	0	0.0
San Bernardino	81	4	4.9	413	33	8.0
San Diego	68	10	14.7	474	29	6.1
San Francisco				30	0	0.0
San Joaquin				11	1	9.1
San Luis Obispo				107	11	10.3
San Mateo	5	1	20.0	168	13	7.7
Santa Barbara				322	87	27.0
Santa Clara				43	0	0.0
Shasta				32	4	12.5
Sierra				68	11	16.2
Siskiyou				122	12	9.8
Solano				3	0	0.0
Sonoma				133	1	0.8
Stanislaus				15	0	0.0
Sutter	7	0	0.0	7	0	0.0
Tehama				35	5	14.3
Trinity				24	8	33.3
Tulare				20	2	10.0
Tuolumne				130	23	17.7
Ventura				190	10	5.3
Yolo	1	0	0.0	25	0	0.0
Yuba				31	0	0.0
Douglas, NV				5	1	20.0
Total	1229	193	15.7	8486	1110	13.1

Source: California Department of Health Services

Plague Surveillance and Control

The California Department of Health Services (CDHS) supervises local, state, and federal agencies to conduct a cooperative statewide plague surveillance program. The CDHS Vector-Borne Disease Section (VBDS) collects, collates, and analyzes information on suspect and confirmed plague activity among humans, domestic pets, and wild animals throughout California. This report summarizes plague activity in California for 2004.

Human cases

There were no human plague cases in California in 2004.

Domestic pets

Veterinarians submitted specimens from six domestic pets with clinical signs suggestive of plague to the CDHS Microbial Diseases Laboratory (MDL) for testing. Animals were residents of Kern (three cats, one dog) and Nevada (two cats) Counties.

In April, the MDL cultured *Yersinia pestis* in pharyngeal swabs from two cats of the same household at Pine Mountain Club, Kern County. Both cats presented to a veterinary clinic with fever, lethargy, anorexia, and dehydration. No lymphadenopathy or respiratory signs were noted. Both cats improved markedly within 24 hours of treatment with IV fluids, oral nutritional supplements, and antimicrobials (cefazolin, enrofloxacin). The Kern County Health Department recommended a seven-day course of tetracycline for the cat's owner and nine veterinary staff who had direct contact with the cats. Staff of VBDS visited the owner's residence, but observed little evidence of rodent die-off. Antibodies to *Y. pestis* were not detected in sera collected from nine California ground squirrels trapped near Pine Mountain Club.

Wild animals

Through the statewide plague surveillance program, blood samples were collected from 505 wild carnivores and eight feral pigs from 26 California counties. Of the 513 total specimens tested, antibodies to *Y. pestis* were detected in 37 (8.7%) of 423 coyotes. In addition, 14 red fox, 2 gray fox, 20 raccoon, 9 mountain lion, 4 bear, 22 striped skunk, 11 bobcat, and 8 feral pigs tested serologically negative. Seropositive carnivores were identified in four counties: Lassen, Modoc, Plumas, and Sierra. Estimated seroprevalence to *Y. pestis* was highest in Plumas County (13 of 35, 37%), followed by Modoc (16 of 45, 35.5%) and Sierra (7 of 21, 33%) Counties. The single coyote sampled in Lassen County was seropositive.

Seven hundred seventy-five wild rodents were sampled from 18 California counties through the VBDS cooperative program, and through an independent program in Los Angeles County. Antibodies to *Y. pestis* were detected in no rodent serum samples in 2004. This is the first year since 1969 that the California plague surveillance program has failed to detect plague antibody among wild rodents.

Twenty-eight wild rodents and nine flea pools from rodents collected in seven California counties were submitted to the CDHS MDL for bacteriologic culture. *Yersinia pestis* was cultured from four yellow pine chipmunks (*Neotamias amoenus*).

One positive chipmunk was found in early June at Grover Hot Springs State Park near Markleeville, Alpine County. VBDS staff investigated and collected sera from 43 wild rodents in the park campground, picnic grounds, and other recreational sites. All 43 specimens were

negative for antibodies to *Y. pestis*. Five flea pools, collected from rodents during the investigation, and one ground squirrel carcass, recovered shortly thereafter, were negative by bacteriologic culture. Plague warning signs were posted at recreation sites at the park. The area remained on alert throughout the remainder of the recreational season, but no additional evidence of plague activity was noted. VBDS plans to re-evaluate the recreation site for plague activity prior to the spring 2005 re-opening.

The other three positive chipmunks, as well as one culture-negative golden-mantled ground squirrel (*Spermophilus lateralis*), were found dead in August and September at the Alpine Meadows campground within the Martis Creek Lake Recreational Area, Nevada County. These rodent deaths suggested that a plague epizootic was occurring among wild rodents. Staff from the Nevada County Health Department and VBDS investigated the apparent epizootic. Antibodies to *Y. pestis* were not detected in sera from 23 chipmunks and 5 ground squirrels. Four pools of fleas collected from these animals tested negative by PCR. The campground was closed to the public in October and VBDS conducted flea control with diazinon bait stations. Rodent control was subsequently conducted by the U.S. Army Corps of Engineers, under contract with a private pest control company.

Table 3. Mammals tested for plague in California, 2004. (All specimens are sera except where otherwise indicated.)

County	No. rodents tested	No. carnivores tested	Positive specimens		
			Species	Result	Month
Location ^a					
Alameda	1	8			
Alpine	45				
Grover Hot Springs State Park			Chipmunk, YP ^b	POS	June
Amador	13	1			
El Dorado	9	5			
Fresno	9	14			
Kern		8			
Pine Mountain Club	9		Domestic Cat ^c	POS	April
Pine Mountain Club			Domestic Cat ^c	POS	April
Lassen	7	1			
Vinton, 4E			Coyote	1:4096	April
Los Angeles^d	209	90			
Madera		9			
Mariposa		10			
Mendocino		15			
Merced		1			
Modoc		45			
Alturas, 10S			Coyote	1:512	June
Alturas, 3N			Coyote	1:128	May
Alturas, 5NE			Coyote	1:1024	June
Alturas, 8E			Coyote	1:256	June
Cedarville, 2S			Coyote	1:256	July
Cedarville, 6E			Coyote	1:1024	June
Cedarville, 6E			Coyote	1:512	June
Cedarville, 6E			Coyote	1:512	July
Eagleville, 3E			Coyote	1:512	July
Eagleville, 3NE			Coyote	1:64	June
Fort Bidwell, 1SW			Coyote	1:32	May
Fort Bidwell, 8E			Coyote	1:512	June
Likely, 3W			Coyote	1:1024	June
Likely, 3W			Coyote	1:1024	June
Likely, 6W			Coyote	1:512	June
Likely, 7W			Coyote	1:1024	June
Mono	15				
Monterey		137			
Nevada	45				
Martis Creek Lake, Alpine Meadows CG			Chipmunk, YP ³	POS	August
Martis Creek Lake, Alpine Meadows CG			Chipmunk, YP ³	POS	September
Martis Creek Lake, Alpine Meadows CG			Chipmunk, YP ³	POS	September
Placer	2	20			
Plumas	15	35			
Beckwourth, 2S			Coyote	1:32	
Beckwourth, 4E			Coyote	1:512	April
Beckwourth, 5S			Coyote	1:512	April
Beckwourth, 8N			Coyote	1:256	April
Beckwourth, 8N			Coyote	1:256	April
Quincy			Coyote	1:128	July
Quincy, 10E			Coyote	1:64	July
Vinton, 2N			Coyote	1:64	July
Vinton, 3SE			Coyote	1:4096	April
Vinton, 3W			Coyote	1:128	April
Vinton, 3W			Coyote	1:256	April
Vinton, 4W			Coyote	1:128	April
Vinton, 4W			Coyote	1:32	April

Source: California Department of Health Services

Table 3, continued. Mammals tested for plague in California, 2004. (All specimens are sera except where otherwise indicated.)

County	No. rodents tested	No. carnivores tested	Positive specimens		
			Species	Result	Month
Location ^a					
Riverside	282	1			
San Benito		7			
San Bernardino	79				
San Diego		26			
San Luis Obispo	2	21			
San Mateo	7	3			
Santa Barbara	21				
Santa Clara		21			
Santa Cruz		1			
Sierra		21			
Calpine, 3W			Coyote	1:64	June
Loyalton, 1N			Coyote	1:4096	April
Sierraville			Coyote	1:32	July
Sierraville, 4N			Coyote	1:128	April
Sierraville, 4N			Coyote	1:512	April
Sierraville, 4S			Coyote	1:512	April
Sierraville, 4S			Coyote	1:64	June
Sonoma		3			
Stanislaus		1			
Tuolumne		9			
Ventura	33				
Total	803	513			

^a Mileage and direction from nearest town may be indicated

^b Carcass

^c Pharyngeal swab

^d Plague surveillance and test results submitted by Los Angeles County Department of Health Services

Abbreviations

Location: CG, Campground

Species: Chipmunk YP, Yellow-pine chipmunk

Source: California Department of Health Services

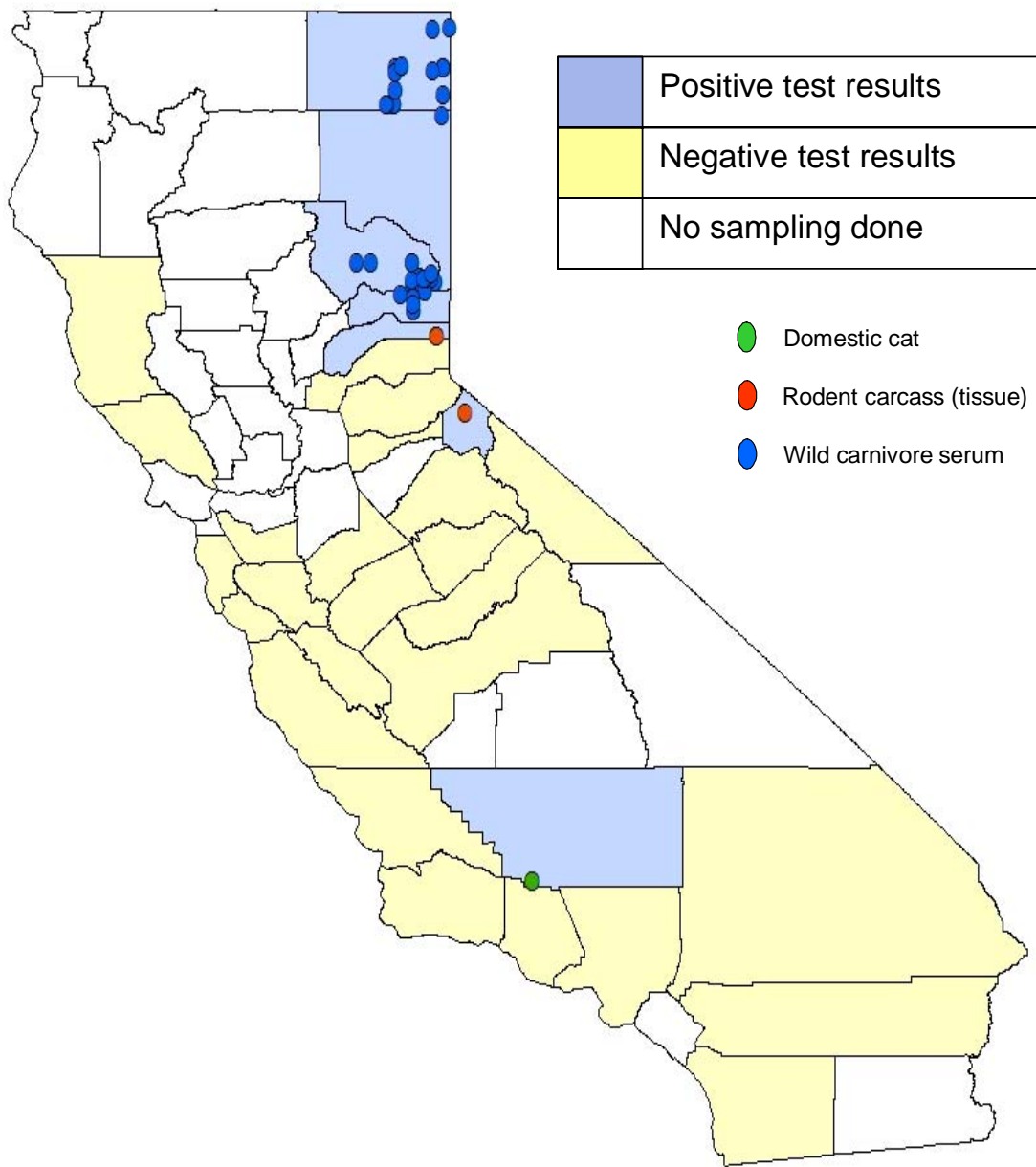


Figure 1. Mammals tested for evidence of *Yersinia pestis*, by county, 2004.

Tick-borne Disease Surveillance

Human disease surveillance

Lyme disease

Fifty-two cases of Lyme disease were reported to the California Department of Health Services (CDHS) in 2004. Case-patients were residents of 24 counties (Table 4). Humboldt County reported the most cases (8) and incidence was highest in Trinity County at 23 cases per 100,000 residents (Figure 2). Of 32 cases for whom site of likely exposure was reported, 12 (37.5%) had exposure outside their county of residence; 7 (22%) of these reported exposure outside California. The most frequently reported location of exposure was Humboldt County (9 cases).

The median age of reported Lyme disease cases was 32 years (range, 3 to 80 years) and 31 (60%) were male. Race was reported as white for 47 (91%) cases, Asian for 3, black for 1, and unknown for 1 case. Erythema migrans (EM) was identified in 23 (44%) cases. Of 22 cases with EM for which date of illness onset was reported, 13 (59%) occurred between May and August.

Anaplasmosis

Two cases of human granulocytic anaplasmosis (HGA, formerly known as human granulocytic ehrlichiosis) were reported to CDHS in 2004. In June, a 53-year-old female resident of Alameda County developed high fever (104°F), headache, malaise, and rash. The CDHS Viral and Rickettsial Disease Laboratory (VRDL) detected antibodies to *Anaplasma phagocytophilum* (IgM >1:40, IgG >1:1024) in a serum specimen collected approximately four weeks after onset. The patient recovered without specific treatment.

The patient reported removing an attached tick from her back at least 12 hours after hiking in Tilden Park, Alameda County. In July 2004, CDHS staff conducted surveillance for ticks at Tilden Park. One *Ixodes pacificus* adult female tick was recovered and tested negative by polymerase chain reaction (PCR) to *A. phagocytophilum* at the United States Army Center for Health Promotion and Preventive Medicine -West at Fort Lewis Washington (USACHPPM). Although *A. phagocytophilum* were detected by PCR in *I. pacificus* collected from Alameda County in 1996, this was the first HGA case reported from this county.

A second case of anaplasmosis was reported in a male resident of San Mateo County. The case-patient had onset of illness in December following a tick bite he received in New Jersey.

Rocky Mountain spotted fever

One case of Rocky Mountain spotted fever (RMSF) was reported to CDHS in 2004. In June, a 52-year-old male resident of San Mateo County presented to an emergency room with fever (101 °F - 104 °F), lethargy, altered consciousness, and hallucinations. The patient was hospitalized and three days later developed a maculopapular rash that began on the palms and soles and expanded to the upper limbs and trunk. Despite initiation of antibiotic treatment, the patient remained comatose with encephalitis for four days. The patient eventually improved and was discharged from the hospital 13 days after admission. The VRDL detected a significant rise in IgG titer to *Rickettsia rickettsii* between acute (1:4096) and convalescent (1:16,384) sera collected approximately seven and seventeen days after onset, respectively. The patient reported travel and camping in Marin and San Mateo Counties in May and June; he had observed ticks but did not recall a specific bite. Staff of Marin-Sonoma Mosquito and Vector Control District and the CDHS Vector-Borne Disease Section (VBDS) collected three male and one female

Dermacentor occidentalis ticks from the Marin County site in July. VBDS and staff from the San Mateo County Mosquito Abatement District collected four male and two female *D. occidentalis*, three male, six female, and one nymphal *D. variabilis*, and one female and five nymphal *I. pacificus* from two sites in San Mateo County in July. The USACHPPM reported detecting by PCR Spotted Fever Group *Rickettsia* in two *D. occidentalis* from Marin County and one *D. variabilis* from San Mateo County.

Tularemia

Three cases of tularemia were reported to CDHS in 2004, two of which were likely acquired through a tick bite. In late May, a ten-year-old male resident of Contra Costa County developed cervical lymphadenitis. He was initially treated as an outpatient but did not improve. The CDHS Microbial Disease Laboratory (MDL) cultured *Francisella tularensis* (Type A) from a lymph node aspirate obtained approximately five weeks after onset. In late June, a five-year-old male resident of Alameda County had similar onset of fever and cervical lymphadenitis. The MDL isolated *F. tularensis* (Type B) from a lymph node culture in July from the Alameda patient. Both patients recovered following short hospitalizations.

The Alameda case-patient had camped in San Mateo County about five days prior to onset and had visited Tilden Park in Alameda County about 10 days earlier. The Contra Costa case-patient also walked trails in Tilden Park in the week prior to onset. Neither patient had any contact with rabbits or other wild animals. Both case-patients reported tick bites to their face or head about three days prior to onset of illness. The tick from the Alameda case was retained and later identified by CDHS staff as an adult *D. variabilis*.

In July, CDHS conducted surveillance for ticks at the Tilden Park and San Mateo locations. Forty *D. occidentalis* were collected from Tilden Park and 16 *D. occidentalis* and 87 *D. variabilis* from the San Mateo location. Ticks were submitted to the Division of Vector-Borne Infectious Diseases, U.S. Centers for Disease Control and Prevention, for culture and PCR. *F. tularensis* (Type B) was identified in the tick recovered from the Alameda patient; all ticks collected in the field were negative.

Tick-borne relapsing fever

Six cases of tick-borne relapsing fever were reported to CDHS in 2004. Case-patients were residents of five counties (Contra Costa, El Dorado, Madera, San Mateo, and Santa Clara) and ranged from 8 to 49-years-old. Five case-patients were likely infected while visiting the western Sierra Nevada; exposure information was unavailable for one case.

Tick surveillance

VBDS and collaborating agencies conducted tick surveillance in 14 counties in 2004. A total of 2,399 *I. pacificus* (2,385 adults and 14 nymphs), 154 *D. occidentalis*, and 103 adult *D. variabilis* were collected. Of these 1,969 *I. pacificus* adults were tested for *Borrelia burgdorferi* in four laboratories (Table 5). Ticks were tested by culture, indirect fluorescent antibody (IFA), and/or PCR. Evidence of *Borrelia* was identified in ticks collected from eight of fourteen counties surveyed. *B. burgdorferi* was detected in 0 of 70 pools by culture, 7 of 323 pools by IFA, and 9 of 144 pools by PCR.

The USACHPPM tested by PCR 1,635 *I. pacificus* collected from El Dorado, Los Angeles, Placer, Riverside, Santa Barbara, Shasta, Trinity, and Tuolumne Counties. Any ticks initially positive for *Borrelia* spp. were tested by an additional PCR assay using *B. burgdorferi*-specific primers. *Borrelia* spp. spirochetes detected in tick pools from Placer (1), Shasta (3), and Trinity (6) Counties did not match the genetic sequence for *B. burgdorferi*. These isolates most closely

resembled *B. miyamotoi*, a *Borrelia* sp. in the relapsing fever genetic complex. *B. miyamotoi* is not known to be pathogenic to humans.

From 1999 to 2004, VBDS conducted tick surveillance at campgrounds in Butte, Shasta, and Trinity Counties to provide specific information on tick-borne disease risk reduction to state park and National Forest personnel at these recreation sites. Adult *I. pacificus* were collected monthly from January through April at 12 sites in the Shasta-Trinity National Forest (Basin Gulch, Dekkas Rock, Hirz Bay, Moore Creek, Nelson Point, McCloud Bridge, Pine Point, Ackerman, Cooper Gulch, Mary Smith, Pigeon Point, and Stoney Point Campgrounds) and at one site in Butte County (Loafer Creek State Recreation Area). Ticks from Shasta and Trinity Counties were tested for *Borrelia* spp. by PCR at the USACHPPM. In 2004, three tick pools from Shasta County and six from Trinity County tested positive for a *Borrelia* spirochete genetically most similar to *B. miyamotoi*. A single pool of *I. pacificus* from Hirz Bay Campground in Shasta County tested positive for *B. burgdorferi*. A subset of ticks collected from Butte County was tested for *B. burgdorferi* infection by IFA at the Washoe County Environmental Health Department in Nevada. Although *B. burgdorferi* was detected in no Loafer Creek ticks tested in 2004, previous collections at this site estimated an infection prevalence of 9.1 percent (range, 0 to 21.5 percent).

A study of the ecology of *I. pacificus* in southern California, initiated in 2001, continued in 2004. VBDS and collaborating agencies (Los Angeles County Department of Health Services, Los Angeles County West Vector Control District, and Riverside County Department of Environmental Health) monitored tick populations and collected questing ticks from six sites at three different geographic locales (Griffith Park, Santa Monica Mountains, and San Jacinto Mountains). Meteorological factors, including rainfall and humidity, were simultaneously monitored. A total of 896 adult *I. pacificus* was collected: 392 from Griffith Park, 443 from the Santa Monica Mountains, and 61 from the San Jacinto Mountains. Data on tick populations, meteorological factors, infections with *B. burgdorferi*, and molecular characterization of *Borrelia* spp. from ticks will continue to be collected to gain a better understanding of the ecology of *I. pacificus* ticks and *B. burgdorferi* in southern California.

Table 4. Reported Lyme disease cases by county of residence, California, 1995-2004.

County	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Incidence per 100,000
											person-years
Alameda	2	2	3	6	3	4	3	5	1	1	0.21
Alpine	0	0	0	0	0	0	0	0	0	0	0.00
Amador	0	0	0	0	1	0	1	0	0	0	0.57
Butte	1	4	53	13	18	3	1	3	2	2	4.89
Calaveras	0	0	0	0	0	1	0	0	0	0	0.25
Colusa	0	0	0	0	0	0	0	0	0	0	0.00
Contra Costa	0	1	6	2	1	1	5	3	4	0	0.24
Del Norte	2	0	1	0	1	0	0	2	0	0	2.17
El Dorado	4	0	3	2	1	0	0	0	0	3	0.81
Fresno	0	1	0	0	0	1	0	0	0	0	0.02
Glenn	0	0	2	0	1	1	0	0	0	0	1.50
Humboldt	4	5	19	20	14	10	4	4	5	8	7.32
Imperial	0	0	1	0	0	0	0	0	0	0	0.07
Inyo	0	0	0	0	0	0	1	0	0	0	0.55
Kern	1	1	2	2	2	2	0	2	1	0	0.19
Kings	0	0	0	0	0	0	0	0	0	0	0.00
Lake	2	0	1	2	1	0	1	0	1	2	1.70
Lassen	0	0	2	1	2	0	0	2	0	0	2.04
Los Angeles	5	2	6	3	7	2	9	6	7	2	0.05
Madera	0	0	0	0	1	0	0	0	0	0	0.08
Marin	10	0	4	8	4	3	1	4	4	0	1.53
Mariposa	0	0	0	0	0	0	0	1	0	1	1.17
Mendocino	12	3	2	16	8	7	4	11	6	3	8.29
Merced	0	0	2	0	1	1	0	0	0	0	0.19
Modoc	0	0	0	0	0	0	0	0	0	0	0.00
Mono	1	1	0	0	1	0	0	0	3	1	5.45
Monterey	2	0	2	1	2	1	0	5	1	1	0.37
Napa	0	1	3	0	2	2	3	3	0	1	1.20
Nevada	0	2	1	4	5	9	6	3	4	1	3.80
Orange	0	0	0	1	2	3	0	3	2	0	0.04
Placer	1	0	5	4	2	1	4	3	0	2	0.88
Plumas	1	3	0	2	1	0	1	0	0	0	3.86
Riverside	0	1	0	0	0	3	2	1	2	1	0.06
Sacramento	1	0	5	1	1	3	4	1	4	3	0.19
San Benito	0	0	0	0	0	0	1	1	0	0	0.37
San Bernardino	1	0	0	0	1	1	0	0	2	0	0.03
San Diego	6	5	4	0	16	9	3	7	2	4	0.20
San Francisco	1	4	1	7	1	2	3	3	3	1	0.33
San Joaquin	0	1	2	0	0	0	0	0	0	0	0.05
San Luis Obispo	0	1	0	1	1	1	0	0	0	0	0.16
San Mateo	1	2	3	4	4	2	4	4	5	1	0.42
Santa Barbara	3	1	1	3	0	0	1	2	2	2	0.37
Santa Clara	2	2	4	6	2	2	2	6	4	0	0.18
Santa Cruz	3	2	2	2	2	5	9	1	8	3	1.44
Shasta	1	1	0	2	0	0	2	1	0	2	0.54
Sierra	0	0	0	0	0	0	0	0	0	0	0.00
Siskiyou	0	0	1	1	0	0	1	1	0	0	0.89
Solano	0	0	0	0	0	1	1	0	0	0	0.05
Sonoma	11	13	10	15	14	8	6	4	9	2	1.99
Stanislaus	0	3	1	0	0	1	1	0	0	0	0.13
Sutter	0	0	1	0	0	1	1	0	0	0	0.38
Tehama	0	0	1	1	0	2	0	0	0	0	0.72
Trinity	0	1	0	1	13	1	1	1	1	3	16.92
Tulare	1	1	0	1	1	0	2	0	2	0	0.22
Tuolumne	0	1	0	0	0	0	2	1	0	0	0.73
Ventura	0	0	0	2	1	2	2	1	1	2	0.15
Yolo	0	0	0	0	0	0	0	2	0	0	0.12
Yuba	1	0	0	1	1	0	0	0	0	0	0.49
Total	80	65	154	135	139	96	92	97	86	52	0.29

Source: California Department of Health Services

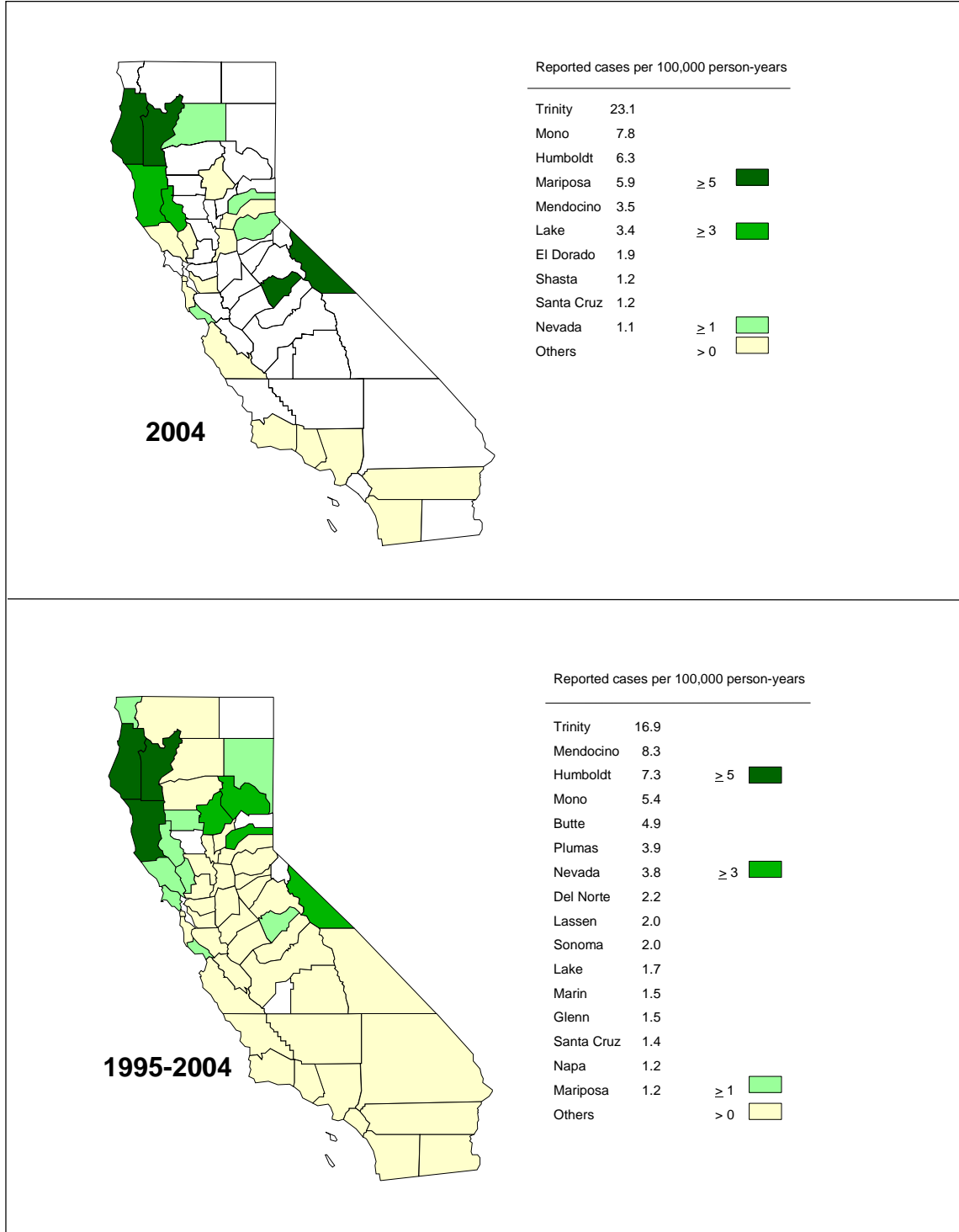


Figure 2. Reported incidence of Lyme disease by county of residence, California, 1995-2004.

Source: California Department of Health Services

Table 5. *Ixodes pacificus* ticks tested for evidence of *Borrelia burdorferi*, California, 2004.

County	Location	No. ticks tested	No. pools tested	No. pools positive					Laboratory
				Culture	IFA	PCR			
						<i>Borrelia</i> spp. ^a	<i>B. burgdorferi</i> ^b	<i>Borrelia</i> sp.	
Butte	Loafer Creek SRA	100	100		0				Washoe Co. EH
El Dorado	El Dorado NF	12	1			1	1		US Army
Los Angeles	Catalina Island - Avalon	75	8			0			US Army
	Catalina Island- Swain's Cyn	182	18			1	1		US Army
	Lower Whites Landing	56	7			0			US Army
Placer	Auburn SRA	52	6			2	2		US Army
	Colfax	116	12			4	3	1	US Army
	Driver's Flat	19	2		0				Placer Co PHL
	Rattlesnake Bar	10	1		0				Placer Co PHL
	Stagecoach Trail	79	8		0				Placer Co PHL
	Steven's Trail	99	10		0				Placer Co PHL
Riverside	Santa Rosa Mountain	3	1			0			US Army
	Spittler Creek Trail	6	3			0			US Army
	Thomas Mountain	16	5			0			US Army
Sacramento	Mississippi Bar	32	6		0				Sac/Yolo MVCD
	Negro Bar	76	12		0				Sac/Yolo MVCD
	Nimbus Dam	30	7		2				Sac/Yolo MVCD
	Snipes Park	21	7		0				Sac/Yolo MVCD
	Willow Creek	54	7		0				Sac/Yolo MVCD
Santa Barbara	Gaviota State Park	20	2			0			US Army
	Lompoc	10	2			0			US Army
	Los Alamos	10	2			0			US Army
	Los Olivos	18	2			0			US Army
	Santa Barbara	40	4			0			US Army
	Santa Maria	20	2			0			US Army
	Santa Ynez	80	8			0			US Army
Shasta	Basin Gulch	54	5			1			US Army
	Shasta Lake - Hirz Bay	111	11			2	1	1	US Army
	Shasta Lake - McCloud Bridge	32	3			1		1	US Army
	Shasta Lake - Moore Creek	30	3			0			US Army
	Shasta Lake- Nelson Point	40	5			0			US Army
	Shasta Lake - Pine Point	41	4			0			US Army
	Shasta Lake - Dekkas Rock	82	9			0			US Army
Trinity	Ackerman Campground	42	42		2				Washoe Co. EH
	Cooper Gulch Campground	80	70	0	0				Washoe Co. EH
	Mary Smith Campground	38	38		0				Washoe Co. EH
	Pigeon Point Campground	22	2			0			US Army
	Steel Bridge Road	42	4			2			US Army
	Stoney Point Campground	99	9			4		3	US Army
Tuolumne	Columbia State Park	14	4			0			US Army
	Twain Hart, Stanislaus NF	12	2			1	1		US Army
Yolo	Cache Creek	94	13		3				Sac/Yolo MVCD
Total ticks tested		1969	451						
Total pools positive					7	19	9	6	

Location: NF, National Forest Test: IFA, Indirect fluorescent antibody
 SRA, State Recreation Area PCR, Polymerase chain reaction
 (two primer sets: first *Borrelia* genus, second *B. burgdorferi* specific).

Laboratory Placer Co PHL, Placer County Public Health Laboratory
 Sac/Yolo MVCD, Sacramento/Yolo Mosquito and Vector Control District
 US Army, United States Army Center for Health Promotion and Preventive Medicine - West
 Washoe Co. EH, Washoe County Environmental Health Department, Nevada

^aPCR primer sets were specific to the level of *Borrelia* genus only.

^bA subset of PCR products positive for *Borrelia* genus but negative for *B. burgdorferi* were sequenced (partial flagellin gene) and found to be most closely related to *B. miyamotoi*.

Source: California Department of Health Services

Mosquito-Borne Encephalitis Virus Surveillance

The California Arbovirus Surveillance program is a cooperative effort of the California Department of Health Services (CDHS), the University of California at Davis Center for Vectorborne Diseases (CVEC), the Mosquito and Vector Control Association of California (MVCAC), local mosquito abatement and vector control agencies, county and local public health departments, and physicians and veterinarians throughout California. Additional local, state, and federal agencies collaborated upon, and contributed to, the West Nile virus (WNV) component of the arbovirus surveillance program (see Acknowledgements, page ii).

In 2004, the surveillance program elements included:

- 1) Diagnostic testing of specimens from human patients exhibiting symptoms of viral meningitis or encephalitis, or with unexplained febrile illness of more than seven days.
- 2) Enrollment of patients diagnosed with encephalitis into the CDHS California Encephalitis Project, which evaluates demographics, exposure to arthropods, and laboratory evidence to determine etiology.
- 3) Diagnostic testing of specimens from equids that exhibit clinical signs of viral neurologic disease compatible with infection with western equine encephalomyelitis (WEE), WNV, and other arbovirus as appropriate.
- 4) Monitoring and testing of mosquitoes for the presence of St. Louis encephalitis (SLE), WEE, and WNV. Tests were also done for dengue and other arboviruses, as appropriate.
- 5) Serological monitoring of sentinel chickens for SLE, WEE, and WNV antibodies.
- 6) Surveillance and diagnostic testing of dead birds, especially crows and other corvids, for infection with WNV.
- 7) Weekly reporting in the CDHS Arbovirus Surveillance Bulletin of arbovirus testing results in California and arbovirus activity throughout the United States.

Arbovirus diagnostic procedures used in 2004 in California are summarized in Table 6.

Human disease surveillance

In 2002, the CDHS Viral and Rickettsial Disease Laboratory (VRDL) initiated a regional network with 33 county public health laboratories to enhance testing of patients in California who met clinical criteria for suspected WNV infection. Specimens in which WNV antibodies were detected by immunofluorescent assay and/or a capture IgM MAC-ELISA assay at the local laboratory were forwarded to VRDL for confirmatory testing. Additional suspect cases of WNV were identified through the California Encephalitis Project, Kaiser Permanente regional laboratories, three commercial reference laboratories, and blood donation centers.

Over 2,800 specimens from 2,389 patients were tested for WNV at VRDL in 2004. The first case of 2004 was a 40-year-old female from San Bernardino County who had onset of West Nile fever in mid-May. In total, 830 WNV infections were identified among residents of 23 counties in California in 2004 (Figure 3). Sixty-six of the 830 WNV infections were detected in blood donors, 15 of whom later developed clinical symptoms consistent with West Nile fever.

Of the 779 symptomatic WNV infections, 395 were classified as West Nile fever, 289 as West Nile neuroinvasive disease (i.e., encephalitis, meningitis, or acute flaccid paralysis), and 95 were of undetermined clinical presentation. Males represented 484 (62%) of 779 cases. The median age for all cases for whom data were available was 52 years (range: 2 – 94 years). The median

age for West Nile fever cases was 50 years (range: 2 –91 years), and for neuroinvasive disease cases 58 years (range: 4 – 91 years). The median age of the 27 WNV-associated fatalities was 76 years (range: 26-94 years).

Equine surveillance

Serum or brain tissue specimens from 1419 horses displaying neurological signs were submitted to the California Animal Health & Safety Laboratory (CAHFS) and CVEC for arboviral testing. WNV infection was detected in 540 horses from 32 counties (Figure 4). Of the 540 infected horses, 229 (42%) died or were euthanatized. Twenty-two horses were properly vaccinated with the WNV vaccine, 145 did not complete the recommended vaccine dosage schedule, 356 were unvaccinated, and vaccination history was unknown for 17.

Adult mosquito surveillance

Forty-one local mosquito control agencies submitted a total of 550,573 mosquitoes (14,809 mosquito pools) to CVEC for virus isolations (Tables 7- 11). WNV was detected in 1,135 pools from 19 counties (Figure 5). In 2004, West Nile virus was first detected from two pools of *Culex tarsalis* collected on April 14 from Riverside County and last detected from one pool of *Culex quinquefasciatus* collected on November 4 in Orange County. WNV was identified for the first time in *Anopheles hermsi*, *Culex thriambus*, *Ochlerotatus melanimon*, and *Ochlerotatus squamiger* in 2004.

Neither SLE nor WEE virus was detected in mosquitoes in 2004.

Chicken serosurveillance

Fifty-three local mosquito and vector control agencies in 39 counties maintained 252 sentinel chicken flocks (Table 7). Blood samples were collected from chickens every other week. The VRDL tested 29,451 chicken sera for antibodies to SLE, WEE, and West Nile viruses. The Sacramento-Yolo Mosquito and Vector Control District (1,600 samples), the Los Angeles County West Vector Control District (2,290 samples), and the San Gabriel Valley Mosquito and Vector Control District (1,498 samples) tested their own sentinel chicken flocks.

A total of 809 seroconversions to WNV were detected among 134 flocks in 22 counties (Table 7, Figure 6). The first WNV seroconversions in sentinel chicken flocks were detected on May 17 from Riverside County.

No seroconversions to SLE or WEE were detected among sentinel chicken flocks in 2004.

Dead bird surveillance for West Nile virus

The WNV dead bird surveillance program, a collaborative program between CDHS and over 130 local agencies and supported by a CDC grant, was established in 2000. In 2004, 93,053 reports of dead birds yielded 8,195 carcasses submitted for testing. Of 5,723 carcasses deemed suitable for testing, WNV was detected in 3,232. WNV was detected in at least one bird carcass recovered from each of California's 58 counties (Table 12). Retrieval and testing of dead birds was continued at the discretion of the local agency following the initial detection of WNV in their jurisdiction.

Prior to 2004, all dead birds reported to the hotline and deemed suitable for testing were tested by PCR and/or virus isolation at CVEC. In 2004, local agencies began to screen birds for WNV using two commercially available rapid assays: RAMP® (Rapid Analyte Measurement Platform, Response Biomedical Corp.) and VecTest™ (Medical Analysis Systems). CDHS and CVEC

validated the VecTest™ against the RT-PCR “gold standard.” In August 2004, CDHS began to accept VecTest™ results as an alternative to PCR for American crows. Of 2,756 American crows tested for WNV in 2004, 85 of 245 were positive by VecTest™ and 1,585 of 2,511 were positive by RT-PCR.

Reports and public education

Between April 23 and December 17, CDHS published weekly bulletins reporting arbovirus surveillance data, as well as updates on national WNV activity. The bulletin was distributed to local, state, and federal public health agencies, universities in California, and other state health departments. The Arbovirus Surveillance Bulletin and other reports were also posted on the California West Nile virus Web site. Summaries of human case occurrence, dead bird submissions and testing, and other information were updated semi-weekly. The Web site also provided WNV preventive information to the general public in five languages and instructions for reporting dead birds.

CDHS supplemented the WNV prevention recommendations available on the Web site by promoting the “Fight the Bite” campaign. Multimedia materials, originally developed by the Colorado Department of Public Health, were adapted for use in California. CDHS provided to local agencies over 200,000 posters, handbills, doorhangers, bookmarks, and wallet cards for customization and dissemination to the public. Over 150,000 print copies of the CDHS WNV brochure were also distributed. CDHS distributed television and radio public service announcements to all major media.

CDHS issued 11 press releases to 350 media outlets to alert the public to the first detection of WNV in a county and to announce other significant surveillance events. CDHS staff provided over 400 interviews to local and national print and broadcast media.

Between May and October, CDHS fielded 147,305 calls to the West Nile virus “hotline” and transcribed information on over 93,000 dead birds reported through the “hotline” and web site (Figure 7). Because of the significantly increased volume of calls (cf. 8,650 calls in 2003), staff used additional resources available through the CDHS Emergency Operations Center to maintain timely response.

CDHS organized meetings of representatives from local districts, universities, and other interested agencies to share and review current WNV information and develop surveillance and prevention strategies. During the summer of 2004, CDHS hosted weekly teleconferences to discuss issues, solutions, and management strategies. VBDS staff gave more than 40 formal presentations, and provided innumerable consultations by phone and in person, on WNV to local agencies, health care providers, and other audiences in 2004 (see Presentations and Publications, page 51).

Table 6. Laboratory test procedures used for the California Arbovirus Surveillance Program, 2004.

Specimen	Screening	Primary Test	Confirmatory Test	Virus(es) Tested
Human sera	Screened by local public health labs and VRDL	EIA for WNV IgM/IgG (VRDL)	PRNT (CVEC/VRDL)	WNV
Human cerebrospinal fluid	Screened by VRDL	EIA for WNV IgM/IgG (VRDL)	PRNT (CVEC/VRDL)	WNV
Equine sera	Per request of the veterinarian	EIA (CVEC)	PRNT (CVEC)	WNV WEE
Equine tissue	Screened by VPHS and CDFA	Virus isolation in VERO cells (CVEC)		WNV WEE
Bird carcasses	Screened by VBDS; necropsy and tissue removal by CAHFS	RT-PCR using a primary set of primers on kidney tissue and cell culture on organ pools (CVEC)	RT-PCR using a set of secondary primers (CVEC)	WNV
Other animals sera	Screened by VPHS	PRNT for sera (CVEC), virus isolation (CVEC)		WNV
Mosquito pools	Collections by local agencies		Multiplex RT-PCR (CVEC)	SLE WNV WEE CE
Chicken sera	Local agency sentinel flocks	EIA (VRDL)	IFA (PRNT as needed - VRDL)	SLE WNV WEE

Abbreviations:	Agencies:	CAHFS, California Animal Health and Food Safety Laboratory CVEC, University of California, Davis, Center for Vectorborne Disease VBDS, Vector-Borne Disease Section, CDHS VPHS, Veterinary Public Health Section, CDHS VRDL, Viral and Rickettsial Disease Laboratory, CDHS
	Assays:	EIA, enzyme immunoassay PRNT, plaque reduction neutralization test IFA, immunofluorescent antibody RT-PCR, reverse transcription-polymerase chain reaction
	Viruses:	SLE, St. Louis encephalitis WNV, West Nile virus WEE, western equine encephalomyelitis CE, California encephalitis

Source: California Department of Health Services

Table 7. Mosquito pools and sentinel chicken flocks tested for West Nile virus, 2004.

County	Agency	No. mosquitoes tested	No. mosquito pools tested	WNV + pools	No. flocks	No. chickens	No. sera tested	WNV + sera
Alameda	Alameda Co. Mosq. Abatement Dist. (MAD)	6,851	157	0	3	21	294	0
Alpine								
Amador								
Butte	Butte Co. Mosq. & Vector Control Dist. (MVCD)	765	19	1	7	77	912	50
Calaveras								
Colusa	Colusa MAD				1	11	140	0
Contra Costa	Contra Costa MVCD	20,649	417	0	4	41	560	0
Del Norte								
El Dorado								
Fresno	Consolidated MAD	4,524	122	13	6	64	883	24
Fresno	Fresno MVCD	1,601	39	1	2	21	320	1
Fresno	Fresno Westside MAD	2,674	56	0	2	20	340	0
Glenn	Glenn Co. MVCD				2	26	306	19
Humboldt								
Imperial	Coachella Valley MVCD				3	65	620	42
Imperial	Imperial Co. Environmental Health	9,753	245	33	4	53	280	14
Inyo	Owens Valley Mosq. Abatement Program	1,617	55	0	3	30	383	0
Kern	Arbovirus Field Station	33,377	854	113				
Kern	Delano MAD				2	19	239	10
Kern	Kern MVCD	20,320	491	100	9	119	1,273	90
Kern	South Fork MAD				1	10	110	0
Kern	Westside MVCD	150	3	0	3	30	421	1
Kings	Kings MAD	150	3	0	4	40	509	2
Lake	Lake Co. Vector Control Dist. (VCD)	16,935	365	17	2	20	272	1
Lassen								
Los Angeles	Antelope Valley MVCD	34	6	0	8	62	587	14
Los Angeles	Greater Los Angeles Co. VCD	87,257	2,437	342	5	146	1,193	45
Los Angeles	Long Beach Environmental Health	13,848	432	30	4	50	479	23
Los Angeles	Los Angeles Co. West VCD	8,611	238	12	20	130	41	39
Los Angeles	San Gabriel Valley MVCD	1,966	71	24	11	70	99	46
Madera	Madera Co. MVCD	1,000	20	0	2	21	196	0
Marin	Marin-Sonoma MVCD	2,145	48	0	5	55	431	0
Mariposa								
Mendocino								
Merced	Merced Co. MAD	12,929	305	1	6	36	509	0
Modoc								
Mono								
Monterey	North Salinas MAD	12	1	0	3	34	388	0
Napa	Napa MAD				6	64	834	0
Nevada								
Orange	Orange Co. VCD	59,534	1,886	164	1	10	138	3
Placer	Placer Co. VCD	3,216	165	4	6	60	828	25
Plumas								
Riverside	Coachella Valley MVCD	57,437	1,595	71	10	197	1,565	70
Riverside	Northwest MVCD	15,842	430	23	6	80	906	55
Riverside	Riverside Co. Environmental Health	13,156	303	9	6	94	974	33
Sacramento	Sacramento-Yolo MVCD	20,360	600	16	5	50	16	15
San Benito								
San Bernadino	San Bernardino Co. Vector Control Program	9,297	280	63	9	152	1,517	71
San Bernardino	West Valley MVCD	8,538	267	65	7	30	485	37
San Diego	San Diego Co. Dept of Health	4,410	92	0	3	30	500	0
San Francisco								
San Joaquin	San Joaquin Co. MVCD	20,410	531	2	6	72	963	11
San Luis Obispo	San Luis Obispo Co.	9,633	207	1	3	31	370	0
San Mateo	San Mateo Co. MAD	1,136	29	0	4	30	380	0
Santa Barbara	Santa Barbara Coastal VCD	7,705	198	0	6	64	998	0
Santa Clara	Santa Clara Co. VCD	718	16	0	4	41	526	4
Santa Cruz	Santa Cruz Co. MVCD	915	24	0	1	10	140	0
Shasta	Burney Basin MAD				2	20	180	0
Shasta	Shasta MVCD	6,605	146	11	5	55	708	5
Sierra								
Siskiyou								
Solano	Solano Co. MAD				2	24	311	0
Sonoma	Marin-Sonoma MVCD				2	22	633	0
Stanislaus	East Side MAD				2	16	225	3
Stanislaus	Turlock MAD	24,816	635	3	7	85	1,340	9
Sutter	Sutter-Yuba MVCD	14,382	307	8	5	50	707	12
Tehama	Tehama Co. MVCD	169	4	0	2	22	197	12
Trinity								
Tulare	Delta VCD	2,827	76	3	6	72	856	3
Tulare	Tulare MAD				2	20	284	8
Tuolumne								
Ventura	City of Moorpark				1	5	95	0
Ventura	Ventura Co. Environmental Health	204	7	0	4	40	709	1
Yolo	Sacramento-Yolo MVCD	23,880	660	5	5	50	12	11
Yuba	Sutter-Yuba MVCD				2	20	269	0
Total		552,358	14,842	1,135	252	2,666	29,451	809

Source: California Department of Health Services

Table 8. Mosquito pools (*Culex* spp.) tested for WNV, 2004.

County	<i>Cx erythrorhax</i>		<i>Cx pipiens</i>		<i>Cx quinquefasciatus</i>		<i>Cx stigmatosoma</i>		<i>Cx tarsalis</i>		Other <i>Culex</i> spp.	
	pools	WNV +	pools	WNV +	pools	WNV +	pools	WNV +	pools	WNV +	pools	WNV +
Alameda	67		68						20			
Butte	1		1						7	1		
Contra Costa	91		29						278			
Fresno	7				95	14			110			
Imperial	50				18				155	33		
Inyo	22								31			
Kern	2				601	119	5		551	94	2	
Kings									3			
Lake	35	1					24	9	261	7		
Los Angeles	485	5			2,046	367	74	6	302	27	24	2
Madera			18						2			
Marin			43				1		2			
Merced	3		124						141	1		
Monterey			1									
Orange	268	1			1,184	153	39	6	160	4		
Placer	6		30				10		56	3	2	1
Riverside	514	8			300	7	19	2	1,381	86	4	
Sacramento	71	1	168	6			6	1	262	8		
San Bernardino	24	3			297	80	39	15	156	30		
San Diego	34				5				40		1	
San Joaquin	2		271	1	1				209	1		
San Luis Obispo	132		17				4		4			
San Mateo	4		13						5			
Santa Barbara	25				12		3		75			
Santa Clara			12						4			
Santa Cruz	16		7						1			
Shasta	2		63	4			3	1	77	6		
Solano												
Stanislaus	121		273	1	8		9		194	2		
Sutter	1		5						232	7		
Tehama									4			
Tulare					59	1	2	1	15	1		
Ventura			2						5			
Yolo			187	1			4		331	4		
Yuba	1		1						13			
Total	1984	19	1333	13	4626	741	242	41	5087	315	33	3

Table 9. Mosquito pools (*Aedes vexans*, *Coquillettidia perturbans*, *Culiseta* spp., *Orthopodomyia signifera*, and *Psorophora columbiae*) tested for WNV, 2004.

County	<i>Ae vexans</i>	<i>Cq perturbans</i>	<i>Cs incidens</i>	<i>Cs inornata</i>	<i>Cs particeps</i>	<i>Ps columbiae</i>	Total pools	WNV +
Contra Costa				1			1	
Fresno			1				1	
Imperial	18					2	20	
Kern				8			8	
Lake	4		1				5	
Los Angeles			193	8	7		208	
Orange			108	14	6		128	
Placer	1		11	2			14	
Riverside	38			67	1	1	107	
Sacramento	18		29		1		48	
San Bernardino	2		17	3			22	
San Diego			4				4	
San Joaquin	22		1				23	
Santa Barbara			6		7		13	
Shasta		1					1	
Solano							0	
Stanislaus			1	1			2	
Yolo							0	
Total	103	1	372	104	22	3	605	0

Source: California Department of Health Services

Table 10. Mosquito pools (*Ochlerotatus* spp.) tested for WNV, 2004.

County	<i>Oc dorsalis</i>	<i>Oc melanimon</i>	<i>Oc squamiger</i>	<i>Oc taeniorhynchus</i>	<i>Oc washinoi</i>	Other <i>Ochlerotatus</i>	Total pools	WNV +
Alameda	2						2	
Butte		10					10	
Contra Costa	5	13					18	
Fresno		4					4	
Imperial	2						2	
Inyo		2					2	
Kern		179					179	1 ^a
Lake		39				1	40	
Marin	2						2	
Merced		37					37	
Orange			7	5	15		27	
Placer		7				3	10	
Riverside						1	1	
Sacramento		38				1	43	
San Diego				8			8	
San Joaquin		25					25	
San Luis Obispo	17		3		29		49	1 ^b
San Mateo	7						7	
Santa Barbara			2	14	32		48	
Stanislaus		28					28	
Solano							0	
Sutter		28					28	1 ^a
Yolo							0	
Yuba		27					27	
Total	35	410	12	27	78	8	570	3

a *Oc. melanimon*

b *Oc squamiger*

Table 11. Mosquito pools (*Anopheles* spp.) tested for WNV, 2004.

County	<i>An franciscanus</i>	<i>An freeborni</i>	<i>An hermsi</i>	<i>An occidentalis</i>	<i>An punctipennis</i>	Total pools	WNV +
Los Angeles	2		43			45	1 ^a
Orange			73			73	
Placer		35			2	37	
Riverside			2			2	
Sacramento		119			2	121	
San Bernardino	2	1	6			9	
San Luis Obispo	1					1	
Santa Barbara	1		21			22	
Total	6	155	145	0	4	310	1

^a *An. hermsi*

Source: California Department of Health Services

Table 12. Dead birds reported and tested for West Nile virus, 2004.

County	Corvid ^a			Non Corvid			All birds		
	Reported	Tested	Positive	Reported	Tested	Positive	Reported	Tested	Positive
Alameda	326	37	5	1172	46	18	1498	83	23
Alpine	8	1	1	5	2	2	13	3	3
Amador	28	6	3	70	8	6	98	14	9
Butte	1267	142	115	367	5	3	1634	147	118
Calaveras	30	2	2	177	10	8	207	12	10
Colusa	49	19	18	22	3	3	71	22	21
Contra Costa	527	56	9	1624	49	10	2151	105	19
Del Norte	8	1	0	14	6	3	22	7	3
El Dorado	222	30	20	385	11	2	607	41	22
Fresno	1181	133	99	1362	40	17	2543	173	116
Glenn	293	81	72	57	3	3	350	84	75
Humboldt	71	17	4	129	32	12	200	49	16
Imperial	11	0		32	1	1	43	1	1
Inyo	60	16	5	82	13	7	142	29	12
Kern	672	92	61	1081	67	26	1753	159	87
Kings	110	19	9	146	6	2	256	25	11
Lake	159	37	29	120	4	1	279	41	30
Lassen	31	9	7	55	10	6	86	19	13
Los Angeles	24107	1064	818	7130	89	22	31237	1153	840
Madera	60	10	4	106	6	3	166	16	7
Marin	351	39	7	436	21	11	787	60	18
Mariposa	6	2	1	41	7	5	47	9	6
Mendocino	132	29	13	95	4	0	227	33	13
Merced	210	36	18	235	36	11	445	72	29
Modoc	4	0		20	2	1	24	2	1
Mono	23	7	4	46	4	2	69	11	6
Monterey	151	14	3	467	19	9	618	33	12
Napa	50	19	3	71	17	3	121	36	6
Nevada	125	28	22	203	4	4	328	32	26
Orange	3555	287	179	1077	97	46	4632	384	225
Placer	653	59	42	738	11	5	1391	70	47
Plumas	31	13	6	64	28	20	95	41	26
Riverside	5044	200	131	1810	49	8	6854	249	139
Sacramento	3284	256	142	2140	49	11	5424	305	153
San Benito	28	7	0	93	12	5	121	19	5
San Bernardino	8505	359	288	2918	27	1	11423	386	289
San Diego	462	172	21	862	162	13	1324	334	34
San Francisco	39	8	1	278	27	13	317	35	14
San Joaquin	599	80	46	694	30	11	1293	110	57
San Luis Obispo	161	29	10	510	25	5	671	54	15
San Mateo	184	29	10	476	20	5	660	49	15
Santa Barbara	191	49	6	304	13	1	495	62	7
Santa Clara	439	106	28	1118	65	18	1557	171	46
Santa Cruz	108	18	11	442	41	25	550	59	36
Shasta	667	94	87	366	7	3	1033	101	90
Sierra	2	1	1	7	3	2	9	4	3
Siskiyou	38	11	9	85	31	25	123	42	34
Solano	307	31	14	517	7	3	824	38	17
Sonoma	477	66	24	767	51	25	1244	117	49
Stanislaus	983	109	79	804	13	3	1787	122	82
Sutter	268	57	25	204	5	3	472	62	28
Tehama	539	117	113	166	8	2	705	125	115
Trinity	4	0		33	11	9	37	11	9
Tulare	503	66	45	515	9	3	1018	75	48
Tuolumne	19	8	7	91	31	27	110	39	34
Ventura	642	63	18	737	42	5	1379	105	23
Yolo	654	58	21	364	12	5	1018	70	26
Yuba	133	18	13	107	0		240	18	13
unknown	136	0		91	0		227	0	0
Total	58791	4317	2,729	34037	1411	503	92828	5728	3232

^a Family Corvidae includes crows and ravens (*Corvus* spp.), magpies (*Pica* spp.), and jays (*Aphelocoma californica*, *Cyanocitta stelleri*, *Gymnorhinus cyanocephalus*).

Source: California Department of Health Services

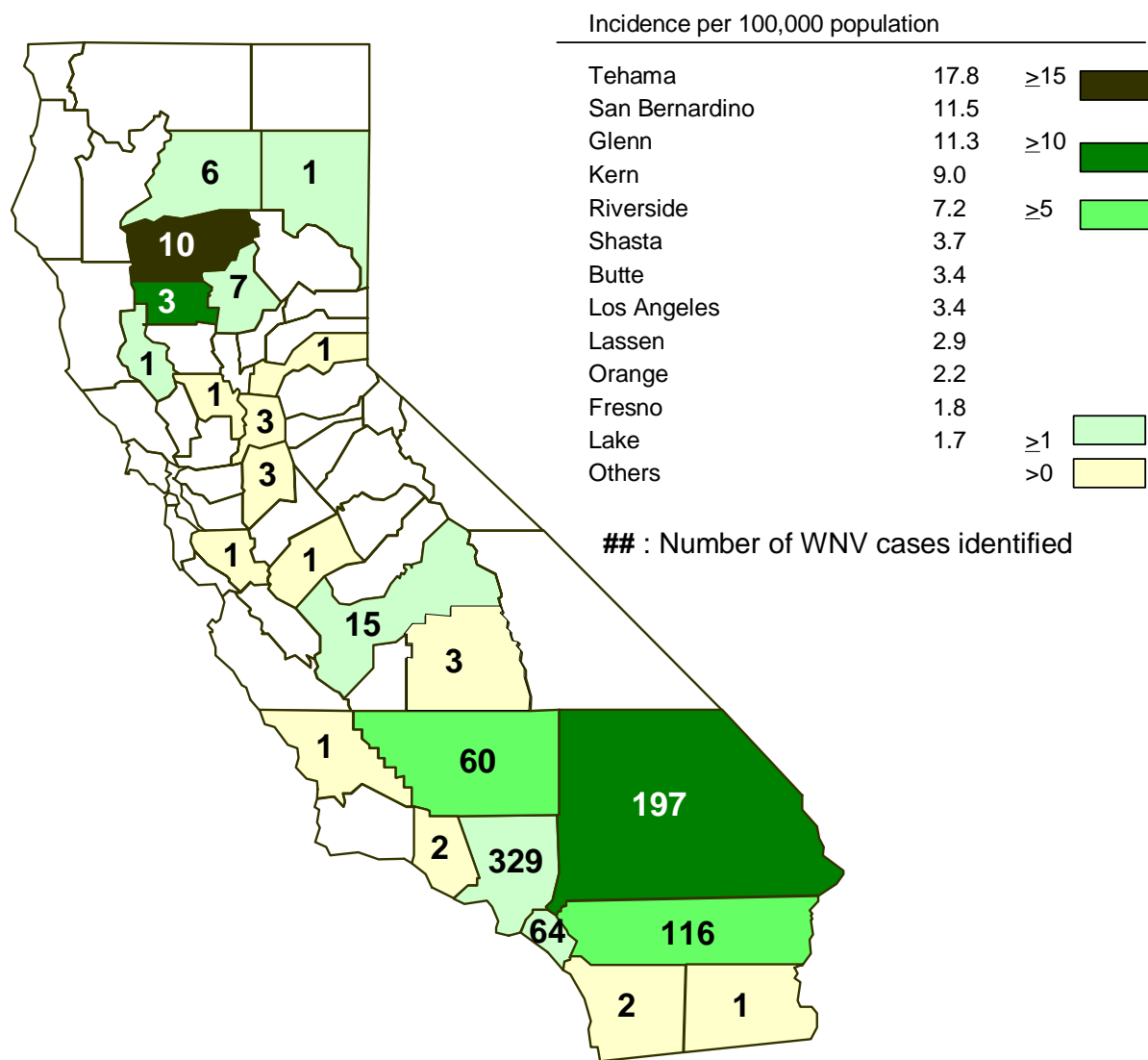


Figure 3. Human cases of West Nile virus infection, 2004.

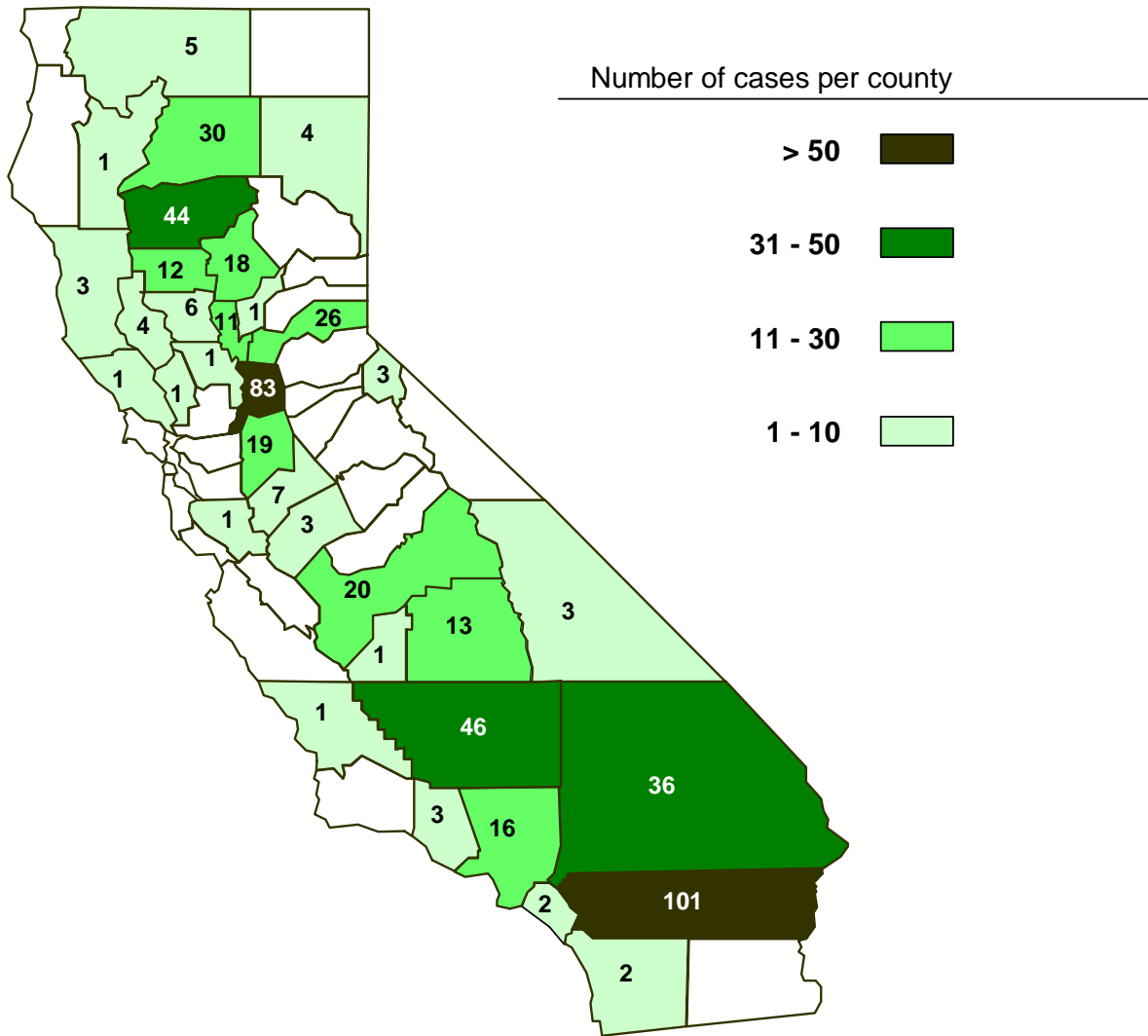


Figure 4. Equine cases of West Nile virus infection, 2004.

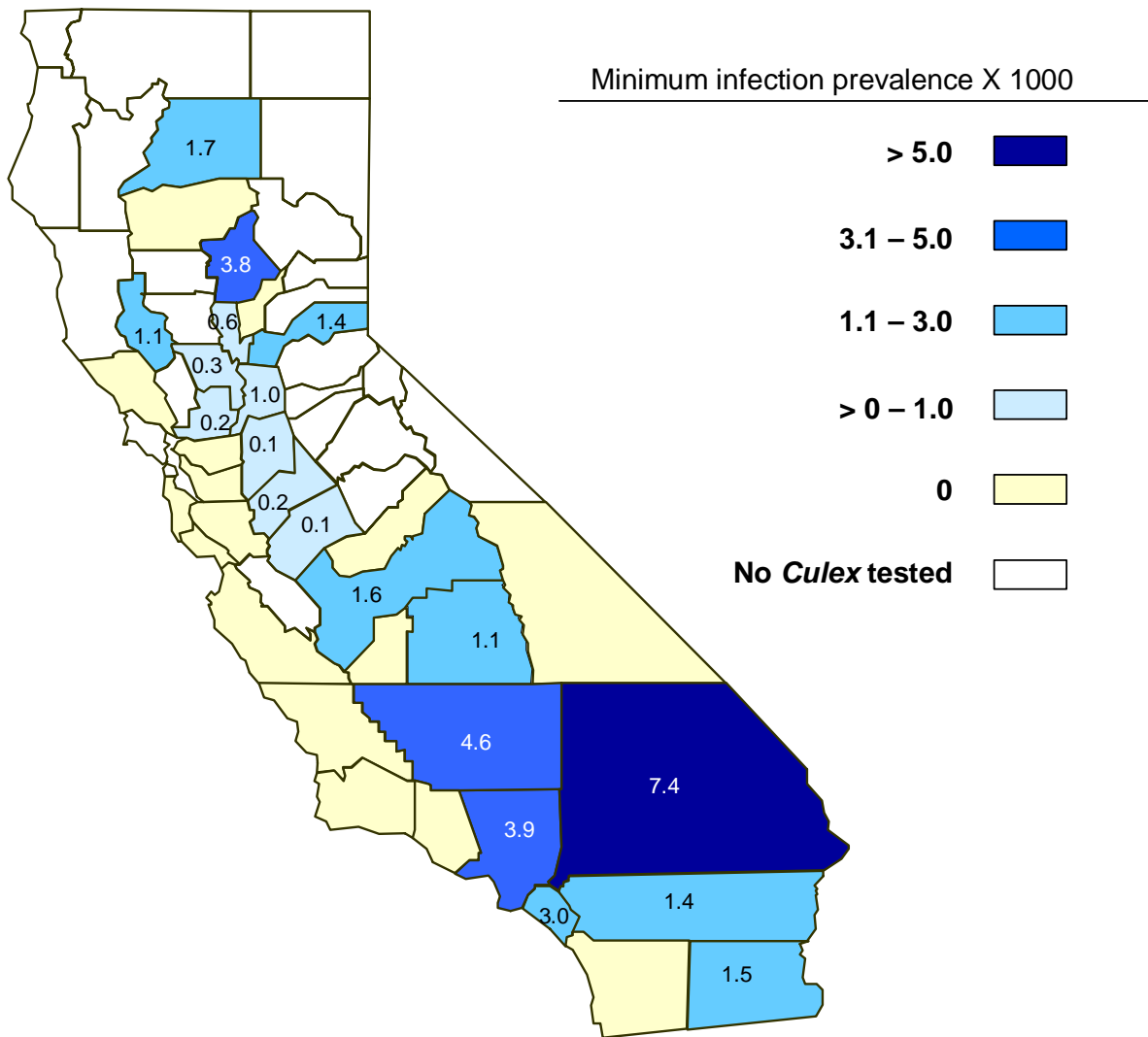


Figure 5. Minimum infection prevalence (No. pools positive X [No. mosquitoes tested]⁻¹ X 1000) of WNV in *Culex* spp., 2004.

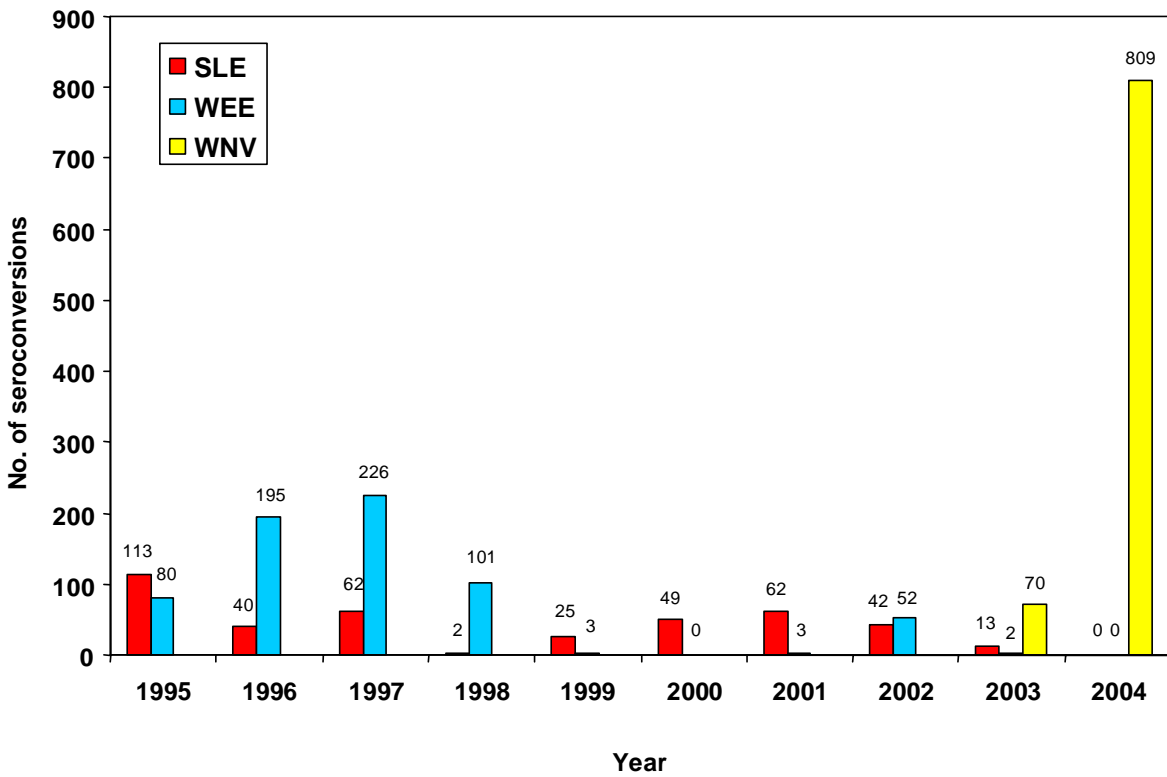


Figure 6. Sentinel chicken flock seroconversions to SLE, WEE, and West Nile viruses, 1995-2004.

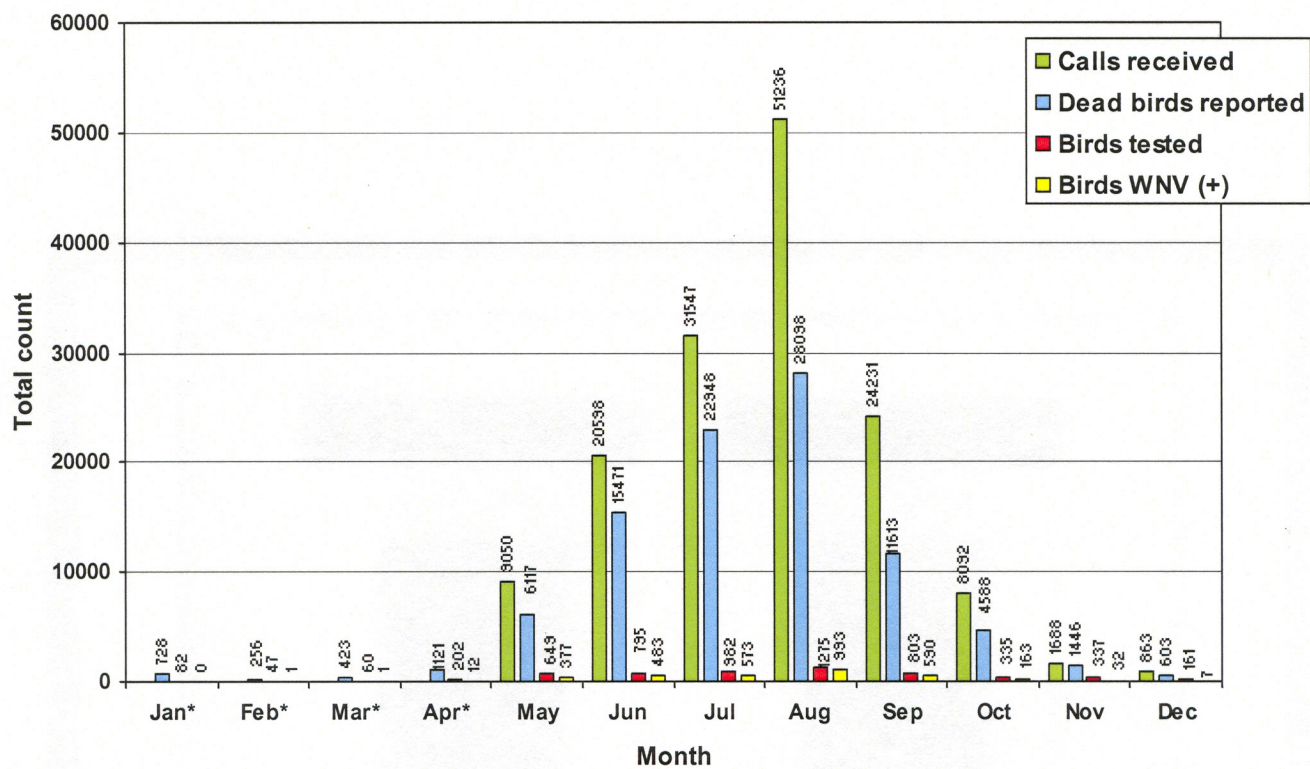


Figure 7. Calls and reports to the CDHS West Nile virus “Dead Bird Hotline,” 2004.

*The number of calls was not tallied for January through April.

Caltrans Stormwater Project Activities

Introduction and background

In 1997, the California Department of Transportation (Caltrans) initiated a Best Management Practice (BMP) Retrofit Pilot Program for treating stormwater runoff from selected facilities in Los Angeles and San Diego Counties. The objective of this program was to evaluate the installation and operation, as well as relative benefits and costs, of various structural “treatment” BMP devices for improving water quality. Caltrans retrofit 39 BMPs at 33 strategically selected project sites (e.g., freeway interchanges, park-and-rides, and maintenance stations) using eight different design types.

Concerned that treatment BMPs could potentially impact public health by increasing habitat available to aquatic stages of disease vectors, particularly mosquitoes, Caltrans and the California Department of Health Services, Vector-Borne Disease Section (VBDS) entered into a Memorandum of Understanding (MOU) in 1999. The primary objective of the MOU was for VBDS to provide technical expertise regarding vector production and the potential of vector-borne diseases within the Caltrans BMP Retrofit Pilot Program. It was the intent of this two-year agreement to document and, where possible, mitigate vector production and harborage at the BMP pilot project sites. Design and maintenance recommendations would be formulated to guide mitigation efforts.

1999-2001

In accordance with project goals, VBDS established a comprehensive vector surveillance and monitoring program and developed vector abatement protocols for the Caltrans BMP Retrofit Pilot Program. Data collected by VBDS and collaborating local vector control agencies between July 1999 and June 2001 revealed that a large percentage of pilot BMP designs, particularly those that held permanent standing water, supported production of mosquitoes. Concurrent with this investigation, VBDS surveyed over 150 agencies nationwide with experience managing or monitoring similar stormwater devices. Survey results corroborated data collected from Caltrans BMPs (i.e., that these devices harbor and produce mosquitoes), providing additional evidence of the potential public health impact created by certain stormwater structures that lack specific provisions for vector management. VBDS offered Caltrans general and specific recommendations for mitigation of mosquito breeding in BMPs that included design changes, specific repairs, exclusion techniques, biological control, and maintenance intervals.

2001-2003

In June 2001, Caltrans extended VBDS funding for an additional two years to continue monitoring those BMPs built as part of the BMP Retrofit Pilot Program and to develop additional recommendations for mitigating vectors. Caltrans funding for local vector control agencies who previously worked with VBDS was also renewed to provide continued vector monitoring of selected BMPs, as well as several new BMP sites in San Diego, Orange, and Los Angeles Counties, and two pilot BMPs in Siskiyou and Shasta Counties. VBDS periodically reviewed pre-construction plans for pilot BMPs, as requested by Caltrans.

In July 2003, VBDS initiated a new project in and around the city of South Lake Tahoe to evaluate mosquito production from region-specific stormwater BMPs, including structures not built or owned by Caltrans. The primary objective was to document mosquito production, species composition, and seasonal abundance in urban BMPs, and compare these data to natural sites in the surrounding area historically known to produce mosquitoes.

Project Activities: 2004

In June 2003, Caltrans extended VBDS funding for a third consecutive term through June 2007. In accordance with this new agreement, VBDS expanded the size and scope of the projects in the Lake Tahoe region and began to monitor a new series of Caltrans pilot BMPs in Orange County.

South Lake Tahoe Project

Between December 2003 and October 2004, VBDS staff, in collaboration with El Dorado County Vector Control, collected mosquito production data from 17 BMPs selected within the city of South Lake Tahoe. These data were compared to mosquito production data collected concurrently from 15 natural water sources. Mosquito breeding was documented at the natural sites between October and May, coinciding with low average daily temperatures and high monthly rainfall totals. As average daily temperatures increased and rainfall decreased in May, natural sites dried up and mosquito breeding was more frequently documented from BMPs. BMPs continued to produce mosquitoes until October, when natural water sources reemerged and mosquito production resumed there. This seasonal pattern was reflected also in the mosquito species present; univoltine "snow melt" species (i.e., *Aedes cinereus*, *Oclerotatus cataphylla*, *Oc. increpitus*, *Oc. hexodontus*, and *Oc. tahoensis*) were common during the winter, whereas opportunistic multivoltine species (i.e., *Culex tarsalis*, *Culiseta incidens*, and *Cs. inornata*) were common during the summer. Mosquitoes were observed more frequently in wet vegetated treatment systems than dry systems.

North Lake Tahoe Project

In June 2004, VBDS developed a project proposal for the northern and western highways of Lake Tahoe, intended to complement and expand upon the work done in South Lake Tahoe. Thirty BMPs representing four designs were randomly selected to be monitored biweekly for evidence of mosquito production. This project is scheduled to continue through 2005.

Orange County Project

The Orange County project, located along State Route (SR) 73, represented the largest and most ambitious Caltrans BMP pilot project since the BMP Pilot Retrofit Program of 1999. Construction of SR-73 in the mid-1990s was highly controversial because it traversed many environmentally sensitive and pristine areas of the county. To minimize environmental impacts, 39 Compost Storm Water Filter™ (CSF) systems were installed as stormwater BMPs along a 15-mile stretch of SR-73. Because Caltrans was not satisfied with the performance of the CSFs, they initiated a comprehensive and aggressive program in 2003 to replace all of the CSFs with new-technology treatment BMP pilots, including optimized detention basins, gross solids removal devices (GSRDs) with sediment traps, and Austin-type sand filters. To date, 18 detention basins and four GSRDs have been constructed. An additional 7 pilot BMPs are scheduled to be completed in 2005. The remaining CSFs are scheduled to be replaced with Caltrans Storm Water Management Plan-approved detention basins.

The objective of these pilot studies is to evaluate the performance of the various treatment technology BMP pilots. To accomplish this, the study will determine the:

- Quantity of runoff treated by the BMP
- Reduction or change in analyte concentrations between the influent and the effluent from the BMP
- Mass and volume of gross solids removed by the GSRDs
- Level of effort required to operate and maintain the BMP
- Level of effort required to control vectors of human disease and nuisance insects, and rodents.

Relative to this final objective, in June 2004 VBDS and Orange County Vector Control District staff began to monitor the 18 completed retrofit BMPs bimonthly for evidence of vector production or conditions conducive to future vector production, with the primary goal of eliminating mosquito breeding habitat.

Education and outreach

In 2004, VBDS continued to prepare and present reports and recommendations on the potential public health impacts created by certain BMP devices and the long-term implications associated with their construction.

VBDS published a web-based manuscript in early 2004 that summarized current knowledge on managing mosquitoes in stormwater treatment devices. This publication filled a critical information void and has since been referenced widely by the stormwater, vector control, and public health communities. This paper was reprinted (with permission) in the Proceedings of the 3rd Annual StormCon Conference.

VBDS gave a total of 12 presentations on stormwater and vector issues in 2004, focused primarily on public health concerns associated with existing and anticipated BMPs needed to meet increasingly stringent stormwater quality requirements. In addition, VBDS was actively involved in the meetings of the Los Angeles County Department of Public Works BMP Task Force and the bimonthly meetings of the California Storm Water Quality Association.

Summary of VBDS activities in 2004

- Regularly inspected southern California Caltrans BMPs for areas of standing water as well as for design and maintenance flaws that had the potential to create vector breeding habitats.
- Initiated a new study in Orange County to evaluate design and construction of pilot BMP structures as they relate to vector production.
- Continued to collect data for the South Lake Tahoe BMP project and prepared preliminary reports.
- Initiated a new study to evaluate mosquito production in highway BMPs located around the northern and western portions of Lake Tahoe.
- Provided Caltrans with comments and recommendations for preventing vector breeding habitats in BMPs based on field observations and/or engineering plans.
- Continued collaboration with local vector control agencies conducting vector surveillance at selected BMP sites.
- Maintained a database on immature mosquito abundance data in BMPs that were monitored by collaborating vector control agencies.
- Presented seminars on issues pertaining to BMP devices and vector production at professional meetings, continuing education seminars, and informal meetings.
- Prepared several publications on BMPs and vectors in an effort to educate both the stormwater and vector control communities.

United States Forest Service Activities

In 1992, the Vector-Borne Disease Section (VBDS) of the California Department of Health Services entered into a Challenge Cost-Share Agreement with the Pacific Southwest Region of the United States Department of Agriculture Forest Service to maintain cooperative surveillance and control of vector-borne diseases within the National Forests. The United States Forest Service (USFS) and VBDS established this agreement to achieve mutually beneficial objectives in pest control and management, mandated by both federal and state law. VBDS and USFS agreed to work cooperatively in planning and implementing vector-borne disease management programs.

In accordance with this agreement, VBDS staff conducted field activities in the following National Forests in 2004: Angeles, Cleveland, Eldorado, Inyo, Klamath, Lake Tahoe Basin Management, Lassen, Los Padres, Mendocino, Modoc, Plumas, San Bernardino, Sequoia, Shasta-Trinity, Sierra, Six Rivers, Stanislaus, and Tahoe. In addition, VBDS provided consultation, certification, and oversight to autonomous agencies (environmental health departments and vector control agencies) concerning vector-borne diseases and pesticide applications for public health purposes on USFS land.

Activities conducted by VBDS staff in National Forests included disease surveillance, risk assessment, risk reduction, and education of USFS personnel and concessionaires. Direct surveillance included the collection and testing of indicator species and vectors for plague, hantavirus, Lyme borreliosis, relapsing fever, and other tick-borne diseases (Table 13); indirect surveillance included visual assessment of vector-borne disease risk factors (e.g., counting active rodents and evaluating rodent burrows for abandonment). Based on surveillance information, risk reduction recommendations for vector-borne diseases were made for recreational areas, fire stations, fire lookouts, employee residences, and work places. Recommendations included control of vectors, rodent management, and habitat modification. Vector suppression actions involving pesticides included training on pesticide safety for USFS personnel or other groups who participated in the control effort. Follow-up evaluations were made to determine whether vector numbers had been adequately reduced. Educational activities involved providing information on specimen collection and identification, vector-borne disease epidemiology, and methods to reduce risk of infection. VBDS staff distributed posters and brochures on plague, hantavirus, Lyme disease, and West Nile virus to ranger district offices, USFS concessionaires, USFS fire stations, and individual campgrounds in regions endemic for these diseases. This report provides detailed information on vector-borne disease activities in individual National Forests during 2004.

Table 13. Laboratory testing of specimens collected on USFS lands, 2004.

National Forest	Hantavirus Surveillance (Rodents)		Plague Surveillance (Rodents)		Plague Surveillance (Carnivores) ^a		<i>Borrelia</i> Surveillance (<i>Ixodes</i> Ticks) ^b		Other Pathogen Surveillance (Other Ticks) ^c	
	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested
Angeles	0	15	0	214 ^d	0	55				
Cleveland	0	24	0	48	0	41	0	48	0	64
Eldorado	51	175	0	5	0	21				
Inyo			0	15						
Klamath										
Lassen	12	71	0	7	1	1				
Los Padres			0	63	0	155				
Mendocino					0	15				
Modoc					16	45				
Plumas	48	482	0	15	13	35				
San Bernardino	10	130	0	70						
Sequoia					0	14				
Shasta-Trinity							10	838 ^e		
Sierra	0	14	0	1	0	19				
Six Rivers	0	9								
Stanislaus	6	26			0	9				
Tahoe	6	17			6	21				
Total, All Forests:	133	963	0	438	36	431	10	886	0	64

^aCarnivore specimens taken directly from or immediately adjacent to USFS lands. Because of the broad home range of carnivores, results obtained can be inferred to a large area, including both USFS and adjacent lands. Many of these specimens were collected by the United States Department of Agriculture, Animal Wildlife Services, through a contractual agreement with DHS.

^b*Ixodes pacificus* ticks tested for infection with *Borrelia* spp. Ticks were tested in collaboration with the United States Army Center for Health Promotion and Preventive Medicine (USACHPPM), the University of California, and the Washoe County (Nevada) Vector Control Laboratory.

^c*Dermacentor occidentalis* ticks tested for infection with *Francisella tularensis* (tularemia) in collaboration with San Diego County Veterinary Laboratory.

^dTesting conducted by the Los Angeles County Department of Health Services.

^eSeven pools of *I. pacificus* ticks were positive for a relapsing fever group *Borrelia* species.

Source: California Department of Health Services

ACTIVITY SUMMARY BY INDIVIDUAL NATIONAL FORESTS

Angeles National Forest

- Conducted hantavirus surveillance in collaboration with the Los Angeles County Department of Health Services Vector Management Program (LACDHSVMP). Antibody to Sin Nombre virus (SNV) was detected in none of 15 rodents tested.
- Conducted plague surveillance in collaboration with LACDHSVMP. Antibody to *Yersinia pestis*, the bacterial agent of plague, was detected in none of 214 rodents tested.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Table Mountain, Lake, and Mountain Oak Campgrounds. Fifteen California ground squirrels and four chipmunks were observed at Table Mountain Campground (113 camp sites) and one chipmunk was observed at Lake Campground. No ground squirrel was observed at Mountain Oak Campground. At the time, the risk of plague transmission was judged to be minimal at these sites.
- The Los Angeles County Agriculture Commissioner's office, in collaboration with LACDHS, applied approximately 826 pounds of Deltamethrin (0.05%) to squirrel burrows at 68 campgrounds covering 977 gross acres to control fleas and reduce the risk of plague transmission.

Cleveland National Forest

- Conducted tick surveys in collaboration with the Northwest Mosquito and Vector Control District (NMVCD). A total of 22 *Ixodes pacificus* adults was collected at two sites. None was positive for *Borrelia burgdorferi*, the bacterial agent of Lyme borreliosis.
- Conducted tick surveys in collaboration with the San Diego County Department of Environmental Health /Vector Surveillance and Control Program (SDDEH/VSCP). Twenty two and four *I. pacificus* adults were collected from Pine Creek and Observatory Campgrounds, respectively. None was positive for *B. burgdorferi* infection. In addition, 64 *Dermacentor occidentalis* adults were submitted to San Diego County Veterinary Laboratory for testing for *Francisella tularensis* infection (tularemia). None was positive.
- Conducted hantavirus surveillance in collaboration with NMVCD. Seventy-four rodents were captured and tested. Antibodies to SNV were detected in five of the serum samples.
- Conducted plague surveillance in collaboration with personnel from SDDEH/VSCP at El Prado, Fry Creek, and Observatory Campgrounds, Descanso and Palomar Ranger Districts. Antibody to *Y. pestis* was detected in none of eight, four, and nine ground squirrels captured from the respective sites.
- Conducted a visual survey of ground squirrel activities (plague risk assessment) at El Cariso, Bluejay, and Upper San Juan Campgrounds. One and three California ground squirrels were observed at Upper San Juan and El Cariso Campgrounds, respectively. No ground squirrel was observed at Bluejay Campground.
- Visited Cleveland National Forest headquarters office and provided brochures on plague, hantavirus, Lyme disease, and West Nile virus.

Eldorado National Forest

- Conducted tick surveys at Bridal Veil Falls picnic area. In May, 12 *I. pacificus* adults were collected in approximately one person-hour of flagging. In October, no ticks were collected in two person-hours of flagging. Survey results and Lyme disease awareness were discussed with the concessionaire host. It was recommended that tall grass adjacent to picnic tables and along secondary trails be cut.
- Conducted hantavirus surveillance in May, July, August, and September at the Lumber Yard Fire Station. Antibodies to SNV were detected in 5 of 20, 9 of 23, 9 of 33, and 2 of 16 deer mice captured during the respective months. Hantavirus surveillance was also conducted in July, August, and September at Leek Springs Fire Lookout. This site was not accessible in May due to snow. Antibody to SNV was detected in 14 of 31, four of 23, and eight of 22 deer mice captured during the respective months. Seroprevalence of SNV antibodies in deer mice at both sites (range, 12.5% to 45%) remained significantly higher than the state average (13%). Information and brochures on hantavirus were presented to fire station personnel.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) in August at the following campgrounds: Caples Lake, Kirkwood Lake, Fashoda, Gerle Creek, Icehouse, Northshore, Northwind, Strawberry Point, Sunset, Wolf Creek, Wright Lake, and Yellowjacket. No evidence of epizootic plague activity was observed at any of these campgrounds. Large numbers of ground squirrels were evident at Icehouse, Northwind, and Strawberry Point. Plague caution signs were posted at these campgrounds and, when possible, plague and hantavirus information were provided to campground hosts and staff. Plague caution signs and plague and hantavirus brochures were also provided to the Truckee Ranger Station.
- Provided brochures on plague, hantavirus, Lyme disease, and West Nile virus to the Pioneer Ranger district.
- Provided vector-borne disease educational materials to the Placerville Ranger District.

Inyo National Forest

- Conducted visual inspections of buildings at the Base Training Center in Independence to evaluate hantavirus transmission risk. Because the building was considered to present a moderate risk of hantavirus transmission to occupants, it was recommended that potentially contaminated areas be disinfected prior to occupation. For continued prevention, it was recommended that the building be remodeled and rodent-proofed.
- Conducted plague surveillance at the Crestview Fire Station. Thirteen chipmunks and two golden-mantled ground squirrels captured and tested; antibody to *Y. pestis* was not detected.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Big Springs, Four Jeffrey, and Shady Rest Campgrounds. Two California ground squirrels, one Belding ground squirrel, and one chipmunk were observed at Four Jeffrey Campground. One chipmunk was observed at each of Shady Rest and Big Spring Campgrounds. At the time, the risk of plague transmission appeared to be minimal at these sites.
- Placed 20 rodent bait stations around the Crestview Fire Station, covering approximately five acres, in an effort to control ectoparasites on rodents. About 2.5 pounds of diazinon 2D were added to these bait stations (total 7.5 pounds administered) three times in 2004.
- Consulted with personnel at the Crestview Fire Station about tick-borne relapsing fever and other vector-borne diseases.

- Gave a presentation on hantavirus transmission risk at the Inyo National Forest Employee Responsibilities Training meeting.
- Gave a presentation on hantavirus, plague, and West Nile virus at the Inyo National Forest Concessionaires meeting.

Klamath National Forest

- Discussed and provided educational materials on hantavirus, Lyme disease, and West Nile virus to staff of the Oak Knoll Fire Station in July. Additional brochures were provided for delivery to Scott River Ranger Station.
- Surveyed mosquito breeding sites in July at the USFS Air Attack facility located at the Montague Airport, Siskiyou County. Mosquitoes were collected from a Mosquito Magnet trap by Siskiyou County Environmental Health and identified to species by VBDS staff. Recommendations included draining, deepening, and removing vegetation from a pond used for water supply at the base after the fire season.

Lake Tahoe Basin Management

- Conducted visual surveys of ground squirrel activities (plague risk assessment) in September at the following campgrounds: Bayview, Camp Richardson Resort, Fallen Leaf, Kaspian, Meeks Bay, William Kent, and the Tallac Visitor Center. Plague caution signs were posted at all campgrounds and, when possible, campground hosts and staff were given information about transmission risks of plague and hantavirus. Increased ground squirrel populations at the Tallac Visitor Center and Fallen Leaf Campground prompted thorough evaluation for evidence of epizootic plague. A focused walk-through inspection, including inspection of rodent burrows, was conducted for approximately two hours at each location. Abundant California, golden-mantled ground squirrels, and yellow-pine and shadow chipmunks were noted at both locations. No signs of epizootic plague activity were observed.
- Discussed providing zoonotic disease safety training to USFS and concessionaire personnel with the unit's District Ranger and Supervising Recreational Officer.
- Discussed the current sciurid rodent management program with the Camp Richardson Resort manager. Few rodent burrows were observed, but evidence of digging was noted near cabin foundations.

Lassen National Forest

- Conducted hantavirus exposure risk assessment in August at Antelope Mountain and Harvey Mountain Fire Lookouts. Hantavirus risk and prevention were discussed with Fire Management staff on site at Antelope Mountain and brochures on plague and hantavirus for staff use were provided. VBDS staff contact information and brochures were also provided to staff at the Harvey Mountain site.
- Conducted hantavirus surveillance in September at Bogard Fire Station and at Antelope Mountain Lookout, Eagle Lake Ranger District, as part of a USFS Region 5 hantavirus risk analysis project. Antibodies to SNV were detected in 5 of 27 *P. maniculatus* collected at Bogard site and 7 of 29 rodents from Antelope Mountain. In addition, seven chipmunks were captured and tested for plague; antibody to *Y. pestis* was not detected. Signs of rodent activity were observed at a communications vault; rodent access points were identified and

indicated to staff on site. Educational materials were provided and hantavirus safety issues were discussed with USFS staff at both locations.

- Conducted a visual inspection of the Almanor Ranger Station facility in September. Signs of rodent activity were observed in the office, barracks, and fire caches. Recommendations regarding rodent access points, decontamination procedures, rodent snap-trapping safety issues, and general hantavirus safety tips and brochures were provided. In October, at the request of the USFS, hantavirus surveillance was conducted at the site. Antibodies to SNV were detected in 1 of 17 *P. maniculatus* captured. The seroreactive mouse was collected from the facility's exercise building. In consultation with the Acting District Ranger and the Province Safety Officer, these results prompted a follow-up visual inspection in November. Recommendations included enhancing employee awareness of the risks posed by rodent contact, establishing in-house decontamination protocols, and detailing increased rodent exclusion efforts throughout the facility.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) in June at Hat Creek and Cave campgrounds, Hat Creek Ranger District. Road counts on two of four loops at Hat Creek totaled greater than one rodent observed (chipmunks and golden-mantled ground squirrels) per campsite (28 rodents/26 sites). Information and educational materials on rodent-borne diseases were provided to campground hosts. Plague caution signs were posted at both campgrounds.
- Discussed rodent-borne disease awareness with campground hosts at Aspen, Christie, Eagle, and Merrill Campgrounds, Eagle Lake Ranger District, including preventive information and protocols for submitting rodent carcasses for plague testing. A visual survey (plague risk assessment) in June at Aspen Campground noted few ground squirrels (8 rodents among 26 campsites).
- Verified that plague caution signs were posted in June at Gurnsey Creek and Battle Creek Campgrounds, Almanor Ranger District. Educational materials were provided to, and submission of rodent carcasses for plague testing was reviewed with, campground hosts.
- Discussed vector-borne disease issues with Recreation and Fire Management staff at Almanor and Eagle Lake Ranger District offices in April. Brochures on hantavirus, plague, Lyme disease, and West Nile virus and plague caution signs were provided.
- Provided hantavirus preventive safety training to over 60 USFS employees at the Almanor Ranger Station in October. Items covered included hantavirus exposure risks, decontamination and clean-up issues, the safe use of snap-traps for rodent removal, and rodent-proofing procedures.
- Presented a summary of findings from recent hantavirus risk assessments conducted at facilities in the Plumas and Lassen National Forests at the Sierra Cascade Province Safety Council meeting in Susanville in December. The presentation emphasized individual responsibility for preventive action and underscored the need for employee recognition of rodent-borne disease issues, providing the tools to mitigate potential workplace rodent infestations, and initiating rodent exclusion repairs to buildings.

Los Padres National Forest

- Conducted tick surveys in January at 10 different localities. *I. pacificus* ticks were found at Fremont, Hi Mountain, Navajo, Sage Hill, and Upper Oso Campgrounds; Aliso Canyon, Red Rock, Rinconada, and Santa Cruz Trails; and Rinconada trail head. No *I. pacificus* ticks were found at Paradise Campground.

- Conducted plague surveillance at Mil Potrero Park, Pine Mountain. Many California ground squirrels were observed. Antibody to *Y. pestis* was detected in none of nine rodents captured. However, the flea index (average of 13.7 fleas per rodent) was high.
- Conducted plague surveillance at Chuchupate Campground. Antibody to *Y. pestis* was detected in none of 33 rodents captured. The flea index was 6.6 for the ground squirrels but very low for the woodrats and deer mice. Seven years of efforts to control fleas through Lufenuron-impregnated bait cubes were suspended in 2004.
- Conducted plague surveillance at Upper Oso Campground. Few ground squirrels were observed in an area where they are typically abundant. Antibody to *Y. pestis* was detected in none of 16 ground squirrels captured. The flea index was 6.8.
- Conducted plague surveillance at Sage Hill Campground. A large number of ground squirrels was observed. Antibody to *Y. pestis* was detected in none of five ground squirrels captured.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at the following campgrounds: Paradise (6 ground squirrels observed), Lower Oso Day Use (1), Los Prietos (2), Whiterock Day Use (0), Fremont (3), Toad Springs (0), Caballo (very few), Davy Brown (0), NIRA (0), Pino Alto Day Use (0), and Figueroa (0).
- Conducted investigation of domestic cat with plague at the owners' residence in Pine Mountain, Kern County (immediately adjacent to Los Padres NF). A few chipmunks and a woodrat den were observed on the property.
- Examined creek pools and a horse trough for mosquito larvae at Upper Oso Campground at request of the campground host. Larvae were found in some pools. Recommendations for control were provided to the campground host.
- Gave a talk on ticks and tick-borne diseases to the Back Country Horsemen of the Los Padres National Forest.
- Incorporated historical climate data into the analysis and manuscript of the Chuchupate plague surveillance project.
- Researched methods for control of problematic yellow jackets at some sites.
- Provided information on vector-borne diseases and VBDS activities to USFS staff at Los Padres National Forest Headquarters and to six District Rangers.

Mendocino National Forest

- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Fuller Grove, Oak Flat, Pogie Point, and Sunset Campgrounds around Lake Pillsbury. Few to moderate numbers of ground squirrels were observed at Oak Flat and Pogie Point, and signs of ground squirrel activity were noted at Fuller Grove. Sunset Campground was closed for remodeling during the time of the survey.
- Assessed risk of plague transmission at each of the above campgrounds and recorded findings on the VBDS Plague Risk Assessment Form. Risk was considered low-to-moderate for Oak Flat Campground and low for the other three campgrounds.

Modoc National Forest

- At the request of the Province Safety Officer, a visual inspection of the Modoc Forest Supervisor's office building was conducted to determine potential hantavirus exposure risks to staff working at the facility. Woodrat activity was found in the crawl space area above the dispatch center. Rodent urine stains were noted on the ceiling and walls. Two primary rodent

access points into the facility were identified near the air conditioning compressor units. Recommendations for rodent-proofing, cleanup of contaminated areas, and professional removal of rodents from the facility were presented to the facility manager and engineer.

- Conducted a visual inspection of a barracks structure located at Warner Mountain Ranger Station, Cedarville, at the request of the Modoc Forest Supervisors. No recent rodent infestation was observed inside. Indications of past woodrat activity were noted in the furnace closet and a long abandoned woodrat nest was discovered under the house near an unsealed foundation crawl space opening. No woodrat odor was detected in the attic space or under the house. Findings and recommendations on rodent exclusion and ventilation of the structure were discussed with on-site staff.
- Conducted a visual survey of ground squirrel activities (plague risk assessment) in May at Lower Rush Creek Campground. Little rodent activity was noted during the survey, consistent with historical observations. Plague caution posters were up.
- Provided brochures on plague, hantavirus, Lyme disease, and West Nile virus in May to USFS staff at the Warner Mountain, Big Valley, and the Devil's Garden Ranger Districts. Plague caution signs were also provided and future campground surveillance for plague was discussed.

Plumas National Forest

- Continued a multi-year hantavirus risk study at Laufman Fire Station, Beckwourth Ranger District. Two successive nights of rodent collection were conducted in April, May, June, July, August, September, and November. A total of 580 rodents was collected over approximately 2450 trap-nights. Serum specimens were collected from a total of 412 rodents. Antibodies to SNV were detected in 27 of 202 *P. maniculatus* and 7 of 211 *P. boylii*. Twenty-five rodents, including three seroreactive rodents, were removed from the interior of buildings, though continued rodents exclusion efforts by station staff prevented mice from establishing indoor infestations. Results were communicated to station management and the Province Safety Officer with reminder to continue rodent exclusion practices through the winter months. Educational materials on hantavirus safety were provided to seasonal fire crew staff. USFS staff were counseled regarding "dry sweeping" risks, especially in the engine bay structures.
- Conducted hantavirus surveillance in July following identification of a hantavirus pulmonary syndrome case. The patient was a university researcher employed on a project funded by the USFS and housed at the University of California at Berkeley School of Forestry facility in Meadow Valley, Plumas County. The facility is operated under a USFS lease. In collaboration with the USFS Sierra Cascade Province Safety Officer and Plumas County Environmental Health staff, VBDS staff conducted rodent trapping and a visual evaluation of the facility. Antibody to SNV was detected in 16 of 51 (31%) mice captured from sites where the patient either worked or was housed. Recommendations were made for measures to reduce and exclude rodents from buildings. Recommendations and training were also provided to the research workers to better protect themselves while handling rodents.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Boulder, Lone Rock, and Long Point Campgrounds. Ground squirrel road counts were made at the Boulder and Long Point sites. Less than one squirrel per campsite was recorded at each campground. Plague caution posters were placed at central locations in each campground by the concessionaire.
- Visited Mount Hough Ranger Station to discuss vector-borne disease issues. Brochures on Lyme disease and hantavirus were provided.

- Discussed vector-borne disease issues with Plumas National Forest Fire Management Officers at the Plumas National Forest headquarters facilities. Discussed safety and training issues necessary for spring and summer seasonal staff. Hantavirus surveillance results from Thompson Peak Lookout and the positive effects of last season's rodent-proofing were also mentioned.
- Discussed vector-borne disease issues and provided educational materials to the High Sierra Campground Management concessionaire group at Antelope Lake.
- Provided brochures on hantavirus, plague, Lyme disease, and West Nile virus, and plague caution posters, to Recreation staff at Mount Hough and Beckwourth Ranger District offices. Discussed hantavirus and plague safety and awareness issues.
- Discussed vector-borne disease issues, including hantavirus, with the Mount Hough and Oroville Ranger District offices Fire Management and Recreation units. Educational materials and plague caution posters were provided.

San Bernardino National Forest

- Conducted tick-borne disease surveillance at areas near the San Jacinto Mountains in collaboration with Riverside County Department of Environmental Health Vector Control Program (RDEH/VCP). A total of 61 *I. pacificus* adults was collected. Results of testing for *B. burgdorferi* infection are pending.
- Conducted hantavirus surveillance at various locations in collaborations with RDEH/VCP and San Bernardino County Department of Public Health, Vector Control Program (SBDPH/VCP). Antibodies to SNV were detected in ten of 130 rodents tested.
- Conducted plague surveillance at Apple White, Forest Falls, and Green Valley Campgrounds in collaboration with SBDPH/VCP. Antibody to *Y. pestis* was detected in none of 36 ground squirrel serum samples.
- Conducted plague surveillance at Boulder Basin, Dark Canyon, Fern Basin, and Marion Mountain Campgrounds in collaboration with RDEH/VCP. Antibody to *Y. pestis* was detected in none of 34 ground squirrel serum samples.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Serrano Group, Hanna Flat, and Meadow's Edge Campgrounds. A total of 14 ground squirrels was observed at Serrano. However, very few (one to three) ground squirrels were observed at Hanna Flat and Meadow's Edge. The risk for plague transmission at these sites appeared to be low.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Apple White Campground. Thirty-three ground squirrels were observed among 42 camp sites.
- Visited Big Bear Ranger Station and Discovery Center and provided brochures on plague, hantavirus, and West Nile virus. Per request, these brochures were also sent to Skyforest and Mill Creek Ranger Stations.

Sequoia National Forest

- Discussed VBDS services and provided educational materials on vector-borne diseases to headquarters staff. Contact information for VBDS biologists was also provided.

Shasta-Trinity National Forest

- Conducted tick surveys in January at Bailey Cove, McCloud Bridge, Nelson Point, and Pine Point recreation sites. Twenty-one, 20, 56, and 20 *I. pacificus* adults were collected from these sites, respectively. A relapsing fever group *Borrelia* species was detected in one pool of ticks from McCloud Bridge.
- Conducted tick surveys in February at Dekkas Rock, Hirz Bay, Nelson Point, Packers Bay recreation sites on Lake Shasta. Eight, 21, 56, and 50 *I. pacificus* adults were collected from these respective sites. Ticks from Dekkas Rock, Hirz Bay, and Packers Bay were submitted for *Borrelia* spp. testing. *Borrelia* sp. spirochetes were detected in two pools of ticks from Hirz Bay: *B. burgdorferi* in one and a relapsing fever group *Borrelia* species in the other.
- Conducted tick surveys in March at Ackerman, Cooper's Gulch, and Mary Smith Campgrounds on Lewiston Lake. Seventy, 60, and 55 *I. pacificus* adults were collected from these respective sites. *B. burgdorferi* was detected in two ticks from Ackerman Campground.
- Conducted tick surveys in March at Stoney Point Campground and at the Stoney Creek Swim and Recreation site on Trinity Lake. Twenty-four and 75 *I. pacificus* adults were collected from the two respective sites. All ticks were submitted for *Borrelia* spp. testing. A relapsing fever group *Borrelia* species was detected in four pools of ticks from Stoney Creek.
- Conducted tick survey in March at Basin Gulch Campground. Fifty-five *I. pacificus* adults were collected from the campground and roadside entrance area. All ticks were submitted for *Borrelia* spp. testing. A relapsing fever group *Borrelia* species was detected in one pool of ticks.
- Conducted tick surveys in April at Dekkas Rock, Hirz Bay, Moore Creek, Nelson Point, and Pine Point Campgrounds on Shasta Lake. Sixty, 31, 15, 30, and 20 *I. pacificus* adults were collected from these respective sites. *Borrelia* spp. was detected in none of the ticks.
- Conducted tick surveys in April at Pigeon Point Campground. Twenty-two *I. pacificus* adults were collected. *Borrelia* spp. was detected in none of the ticks.
- Conducted tick surveys in November at recreation sites around Shasta Lake. Five, 33, and 31 *I. pacificus* adults were collected from Dekkas Rock, Hirz Bay, and Nelson Point, respectively. No *Ixodes* ticks were recovered from two sites on Trinity Mt. Road.
- Conducted a visual survey of ground squirrel activities (plague risk assessment) in June at Basin Gulch Campground within the Yolla Bolla Ranger District. No ground squirrels and only one chipmunk were observed. Discussed hantavirus prevention at lookouts and fire stations with the Fire Management Officer at the Hayfork Ranger Station office. Educational materials on vector-borne diseases and VBDS services were provided.
- Provided educational materials on vector-borne diseases to staff at the Harrison Gulch Ranger Station in March. Rodent exclusion and snap-trapping efforts at the facility were discussed following implementation of an exclusion/control maintenance program three years ago.
- Provided educational materials on vector-borne disease to the Mount Shasta Ranger District office. Discussed hantavirus safety issues with the district's Fire Management Officer. Rodent exclusion and the use of snap traps for rodent removal were suggested. The use of alternatives to bleach for decontamination and cleanup in facilities was also clarified.

Sierra National Forest

- Conducted hantavirus surveillance in August at Glenn Meadow, Dinkey Creek, and Teakettle facilities as part of a USFS Region 5 hantavirus risk assessment project. No *Peromyscus* spp. were captured at Glenn Meadow. Six and nine *P. maniculatus* were captured at Dinkey

Creek and Teakettle, respectively. Antibody to SNV was not detected in any of these rodents. Surveillance findings and hantavirus risk reduction recommendations were provided to the Province Safety Officer.

- Presented information on vector-borne diseases and VBDS services to the Provincial Safety Officer and personnel of the Sierra National Forest.
- Discussed vector-borne disease issues and provided educational materials to the North Fork Ranger District, Bass Lake Information Center, and Clearwater Fire Station in August.

Six Rivers National Forest

- Conducted hantavirus surveillance in June at the Salyer Fire Station facility at the request of the Fire Management Officer at the Lower Trinity Ranger District. Inspected facility buildings and set traps at three facility areas (residential, storage, and shop buildings/engine bays). Six *P. boylii* and three *M. californicus* rodents were captured. Antibody to SNV was detected in none of these rodents. Information about hantavirus transmission risk and suggestions on rodent exclusion and control (snap-trapping safety guidelines) were provided and communicated to district personnel.

Stanislaus National Forest

- Conducted tick surveys in May at North Fork Tuolumne River Picnic/Day Use Area and Cottage Springs Picnic Area. No ticks were collected during approximately one person-hour of flagging.
- Conducted hantavirus surveillance in September at Hathaway Pines Work Center, Dorrington Fire Station, and Alpine Ranger Station as part of a USFS Region 5 hantavirus risk assessment project. No *Peromyscus* spp. were captured at Hathaway Pines. Antibody to SNV was detected in one of three *P. maniculatus* captured at Dorrington and five of 22 *P. maniculatus* and one of one *Microtus* sp. captured at Alpine. Surveillance findings and recommendations for reducing the risk of hantavirus transmission were provided to the Province Safety Officer.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at Silver Tip and Alpine West Campgrounds in May. Very little rodent activity was observed, though snow was still on the ground. Plague and hantavirus brochures as well as plague caution posters for use at these campgrounds were provided to the concessionaire host at Alpine West.
- Gave a presentation on the VBDS-USFS Cost Share Agreement and an overview of vector-borne diseases at the Stanislaus National Forest safety officers' meeting in Sonora in February.
- Provided educational materials on vector-borne diseases to the Mi-Wok Ranger District in March.

Tahoe National Forest

- Conducted hantavirus surveillance in September at the USFS Truckee Work Station as a part of a USFS Region 5 hantavirus risk assessment project. Antibodies to SNV were detected in six of 17 *P. maniculatus* captured at the facility. Hantavirus transmission risk reduction information was provided to the staff at the Truckee District Office.
- Conducted visual surveys of ground squirrel activities (plague risk assessment) at the following campgrounds and work areas: Cold Creek, Cottonwood, Granite Flat, Goose Meadows,

Indian Springs, Silver Creek, Truckee Work Station, and Upper and Lower Little Truckee. No evidence of epizootic plague activity was observed at any of these sites. Granite Flat, Goose Meadows, and Silver Creek Campgrounds had large numbers of ground squirrels. Many ground squirrel were also noted at Truckee Work Station and behind the Truckee Ranger Station. Major road construction activities may have contributed to increased rodent counts in the area. Plague caution signs were posted at all campgrounds listed above and, when possible, campground hosts and staff were given plague and hantavirus information. Plague caution signs and plague and hantavirus brochures were provided to the Truckee Ranger Station.

- Conducted visual surveys of ground squirrel activities (plague risk assessment) in August at the following campgrounds: Sagehen Creek, Prosser, Lakeside, French Meadows, Boca Springs, Boca Rest, Boca, Ahart, Cold Creek, Boyington Mill, and Logger. No evidence of epizootic plague activity was observed at any of these campgrounds. Sagehen, Boca, Prosser, and Logger had large numbers of ground squirrels. Plague caution signs were posted at all campgrounds listed above and, when possible, campground hosts and staff were given plague and hantavirus information. Plague caution signs and plague and hantavirus brochures were also provided to the Truckee Ranger Station.
- Discussed vector-borne disease issues and provided brochures on hantavirus, plague, Lyme disease, and West Nile virus to staff at the Sierraville Ranger District office in May. Plague caution signs for campground posting were also provided. Hantavirus safety issues relating to facility management efforts were emphasized following identification of a human hantavirus case that occurred in a Sierraville resident during October 2003.

SPECIAL PROJECT: USFS Region 5 Hantavirus Risk Assessment Project

In July, staff of VBDS and the CDHS California Epidemiologic Investigation Service (Cal-EIS) initiated a year-long project to evaluate factors associated with maintenance and transmission of hantavirus at facilities maintained and occupied by the U.S. Forest Service in California. Variables being evaluated included: (1) person-time exposure; (2) employee training and education; (3) rodent opportunity, incentives, and activity; and (4) SNV activity based on rodent serology. Criteria for site selection included accessibility, Forest Service recommendations and requests, personnel density, and existing data. The following is a summary of information collected as part of this project in 2004:

Eldorado National Forest

Lumberyard Fire Station: SNV antibodies detected in 2 of 16 (12.5%) *P. maniculatus*.

Leek Springs Lookout: SNV antibodies detected in 8 of 22 (36%) *P. maniculatus* and none of five *M. longicaudus*.

Lassen National Forest

Bogard Fire Station: SNV antibodies detected in 5 of 27 (18.5%) *P. maniculatus*.

Antelope Mt. Lookout: SNV antibodies detected in 7 of 27 (26%) *P. maniculatus*.

Almanor Ranger Station: SNV antibodies detected in 1 of 17 (6%) *P. maniculatus*.

Plumas National Forest

Laufman Fire Station: SNV antibodies detected in 12 of 74 (16%) *P. maniculatus* and 0 of 26 *P. boylii*.

Sierra National Forest

Glenn Meadow: No rodents were captured.

Dinkey Creek: SNV antibodies detected in none of six *P. maniculatus*.

Teakettle: SNV antibodies detected in none of eight *P. maniculatus*.

Stanislaus National Forest

Hathaway Pines Work Center: No rodents were captured.

Dorrington Fire Station: SNV antibodies detected in one of three (33%) *P. maniculatus*.

Alpine Ranger Station: SNV antibodies detected in 5 of 22 (23%) *P. maniculatus* and one of one *Microtus* sp.

Tahoe National Forest

Truckee Work Center: SNV antibodies detected in 6 of 17 *P. maniculatus*.

OTHER SERVICES PROVIDED:

- Sent out a pre-season letter to all USFS Forest Supervisors, District Offices, and campground concessionaires via an electronic mail distribution list. This letter described the services that the VBDS staff can provide to the USFS and included contact information for VBDS biologists.
- Provided training in vector-borne disease epidemiology and vector control to USFS personnel, county environmental health departments, and vector control districts that work on USFS lands. Training is provided through annual workshops, special seminars and presentations, and hands-on field training.
- Updated a contact list of USFS biologists, district rangers, fire management officers, recreation officers, and safety officers for each Forest. This contact list will assist VBDS biologists to communicate investigation and surveillance findings to appropriate USFS personnel and will also help to ensure that all areas of the USFS in California receive service by VBDS.
- Provided USFS report to the CDHS Vector Control Advisory Committee during annual meeting in Sacramento.
- Continued the multi-agency tick surveillance study to better understand the ecology of *I. pacificus* ticks and tick-borne disease transmission risks in southern California. Some of the sites selected are within San Bernardino National Forest. This surveillance project, which was initiated in 2001, is being conducted in collaboration with RDEH/VCP.
- Published "Preventive measures for reducing the risk of tick-borne relapsing fever in Mono and Inyo Counties, California" in the Proceedings and Papers of the Seventy-Second Annual Conference of the Mosquito and Vector Control Association of California. Some of the data included in the paper were collected in Inyo National Forest.
- Published "Seasonal abundance of adult *Ixodes pacificus* in the San Jacinto Mountains, Riverside County" in the Proceedings and Papers of the Seventy-Second Annual Conference of the Mosquito and Vector Control Association of California. The data presented in the paper were collected in San Bernardino National Forest.
- A presentation entitled "A preliminary report on hantavirus dynamics within a mixed rodent community in northeastern California" was given at the Seventy-Second Annual Conference of the Mosquito and Vector Control Association of California. Some of the data presented were collected from Plumas and Eldorado National Forest sites.
- A presentation entitled "Hantavirus: risk reduction at USFS facilities" was given at Province Safety Committee Meeting (Lassen, Plumas, and Modoc National Forests), held at Susanville, California.

Vector Control Technician Certification Program

The California Department of Health Services (CDHS) administers the Public Health Vector Control Technician certification examination in May and November each year. The purpose of this examination is to certify the competence of government agency personnel to control vectors for the health and safety of the public. Authority to administer this exam derives from the Health and Safety Code, Section 106925, which requires every government agency employee who handles, applies, or supervises the use of any pesticide for public health purposes to be certified by CDHS. CDHS first sponsored certification examination of agency personnel on mosquito control in April 1974. Standards governing certification of local agency vector control personnel are described in Title 17 of the California Code of Regulations, Sections 30001-30061.

To become certified in a control category, applicants must pass the Core section and at least one Specialty section of the examination. Each applicant to the examination pays a fee for each section requested on the application. The Core section consists of questions about the safe and effective use of pesticides. Specialty sections of the examination are Biology and Control of Mosquitoes in California, Arthropods of Public Health Significance in California, and Vertebrates of Public Health Importance in California (Table 14). Successful examinees are issued a gold certification card that is valid for two years in the qualified categories specified on the card. To maintain full certification status in subsequent two-year cycles, Certified Technicians must pay annual renewal fees and fulfill minimum continuing education requirements. Successful examinees who elect not to participate in continuing education are issued parchment certificates in the categories in which they qualified. These Certified Technicians (Limited) employees may use pesticides only under the direct supervision of a Certified Technician.

Through 2004, 1,156 Vector Control Technicians employed at 106 local public health agencies held 2,466 certificates (Table 15). The agencies include 54 Mosquito Abatement Districts, Mosquito and/or Vector Control Districts and other special districts, 38 departments of county government, 13 departments of city government, and the CDHS. Table 16 compares the certification status among employees of Mosquito and Vector Control Association of California (MVCAC) corporate member agencies and non-MVCAC member agencies.

During the 2003–2004 continuing education cycle, four approved continuing education programs were made available on videotape to vector control agencies. Each videotape offered at least five continuing education units in the Core or one of the three specialty areas.

Table 14. Results of certification examinations administered in 2004.

Exam section	No. exams given	No. passed (%)
Core	139	86 (61.9%)
Mosquito Control	131	78 (59.5%)
Terrestrial Invertebrate Control	77	29 (37.7%)
Vertebrate Vector Control	87	63 (72.4%)
Totals	434	256 (59.0%)

Table 15. Vector Control Technician certificates in effect as of December 2004.

Certification category	No. certificates		
	Full status	Limited status	Total
Mosquito Control	657	208	865
Terrestrial Invertebrate Vector Control	506	220	726
Vertebrate Vector Control	533	342	875
Totals	1696	770	2466

Table 16. Certification status among MVCAC corporate member agencies and non-MVCAC agencies.

Agency type	Certified Technicians		Certified Technicians (Limited)	
	No. agencies	No. employees	No. agencies	No. employees
MVCAC	54	590	16	117
Non-MVCAC	25	98	32	351
Totals	79	688	48	468

Source: California Department of Health Services

Staff Presentations and Publications

Presentations

JANUARY

- **Hantavirus pulmonary syndrome and WNV in California**
Larry Bronson: Continuing Education in Pest Management Seminar, Plumas County Agricultural Commissioners Office, Quincy.
- **Ticks and tick-borne diseases**
Richard Davis: Back Country Horsemen of the Los Padres National Forest, Atascadero.
- **West Nile virus: An overview in California**
Al Hom: San Juan Bautista High School, San Juan Bautista.
- **Unintended consequences of stormwater treatment**
Marco Metzger: Impact of Stormwater Treatment Devices (BMPs) on Mosquito Production and Public Health Workshop, Santa Fe Springs.
- **Managing mosquitoes in stormwater treatment devices.**
Marco Metzger: Impact of Stormwater Treatment Devices (BMPs) on Mosquito Production and Public Health Workshop, Santa Fe Springs.

FEBRUARY

- **Rodent-borne viruses in California**
Curtis Fritz: Annual Conference of the Western Section of The Wildlife Society, Rohnert Park.
- **Malaria: California's forgotten vector-borne disease**
Curtis Fritz: Quarterly Epidemiologists Meeting, California Department of Health Services (CDHS), Sacramento.
- **Malaria: California's forgotten vector-borne disease**
Curtis Fritz: Annual Meeting of the Northern California Parasitologists, Davis.
- **Malaria: California's forgotten vector-borne disease**
Curtis Fritz: 72nd Annual Conference of the Mosquito and Vector Control Association of California (MVCAC), Sacramento.
- **Surveillance for mosquito-borne encephalitis activity and human disease in California, 2003**
Al Hom: 72nd Annual Conference of the MVCAC, Sacramento.
- **Temporal distribution of adult *Ixodes pacificus* ticks in southern California**
Renjie Hu: 72nd Annual Conference of the MVCAC, Sacramento.
- **Public health approaches to physician education on tick-borne diseases in California**
Anne Kjemtrup: 72nd Annual Conference of the MVCAC, Sacramento.
- **Public health approaches to physician education on tick-borne diseases in California**
Anne Kjemtrup: Annual Meeting of the Northern California Parasitologists, Davis.
- **Vector-borne diseases in California: An update**
Vicki Kramer: State Public Health Vector Control Conference, Denver, Colorado
- **West Nile virus: A California and national update**
Vicki Kramer: Annual Conference of the Western Section of The Wildlife Society, Rohnert Park.
- **Successfully managing mosquitoes in stormwater treatment devices**
Marco Metzger: 72nd Annual Conference of the MVCAC, Sacramento.
- **Hantavirus dynamics within a mixed rodent community in northeastern California**
Jim Tucker: 72nd Annual Conference of the MVCAC, Sacramento.
- **Risk of tick-borne relapsing fever in Mono County, California**
Todd Walker: 72nd Annual Conference of the MVCAC, Sacramento.

- **Vector-borne disease in National Forests**

Todd Walker: Sierra National Forest, Clovis.

MARCH

- **Surveillance for rodent-borne diseases**

Richard Davis: Zoonotic Diseases and California Vertebrates Continuing Education Workshop, Vacaville.

- **Ticks and tick-borne diseases**

Richard Davis: University of California, Santa Barbara Sedgwick Reserve Docents, Santa Ynez.

- **The California ground squirrel: Biology, management, and control**

Richard Davis: University of California, Santa Barbara Sedgwick Reserve Docents, Santa Ynez.

- **The Black Death: A danse macabre with plague through the ages**

Curtis Fritz: Epidemiology & Control of Infectious Diseases, School of Public Health, University of California, Berkeley.

- **Hantavirus pulmonary syndrome**

Curtis Fritz: Epidemiology & Control of Infectious Diseases, School of Public Health, University of California, Berkeley.

- **West Nile virus in North America: The story so far...**

Curtis Fritz: Epidemiology and Control of Zoonotic Infections, Center for Infectious Disease Preparedness, School of Public Health, University of California, Berkeley.

- **Lyme disease: Epidemiology, diagnosis, treatment, and prevention**

Curtis Fritz: Epidemiology and Control of Zoonotic Infections, Center for Infectious Disease Preparedness, School of Public Health, University of California, Berkeley.

- **Zoonoses**

Curtis Fritz: Zoonotic Diseases and California Vertebrates Continuing Education Workshop, Vacaville.

- **Mosquitoes and urban stormwater systems**

Marco Metzger: Urban Runoff Task Force Meeting, State Water Resources Control Board and Regional Water Quality Control Boards, Sacramento.

- **Managing mosquitoes in stormwater treatment devices**

Marco Metzger: Construction Storm Water Compliance Workshop, The Building Industry Association of Southern California, Ontario.

- **West Nile virus update**

Mark Novak: California Department of Fish and Game Pesticide Applicators Seminar, Fish Camp.

- **Control of rodent-borne diseases**

Mark Novak: Zoonotic Diseases and California Vertebrates Continuing Education Workshop, Vacaville.

- **West Nile virus dead bird surveillance program**

Kerry Padgett: Zoonotic Diseases and California Vertebrates Continuing Education Workshop, Vacaville.

- **Hantavirus update**

Jim Tucker: Zoonotic Diseases and California Vertebrates Continuing Education Workshop, Vacaville.

- **Ticks of public health importance in California**

Jim Tucker: Pesticides Applicators Professional Association Seminar, Sacramento.

APRIL

- **Hantavirus risk reduction**

Larry Bronson: Lassen Volcanic National Park Headquarters, Mineral.

- **Vector-borne diseases in California overview**

Richard Davis: Hancock College Microbiology Classes, Santa Maria.

- **Epidemiology of tick-borne diseases in California**

Anne Kjemtrup: Santa Cruz County Public Health Department Grand Rounds, Santa Cruz.

- **West Nile virus in southern California**

Renjie Hu: Annual Meeting of American Hakka Association of California, El Monte.

- **Tick-borne diseases with focus on Lyme disease**

Renjie Hu: Vector-Borne Disease Surveillance and Control Symposium, San Diego.

- **Managing mosquitoes in stormwater treatment devices**

Marco Metzger: California Stormwater Quality Association Workshop, San Diego.

- **Living with West Nile virus in California**

Marco Metzger: Caltrans Office of Safety and Health, District 8, San Bernardino.

- **Proper methods of reporting pesticide use**

Mark Novak: MVCAC Northern San Joaquin Valley Regional Continuing Education, Modesto.

- **Plague surveillance and control**

Mark Novak: MVCAC Northern San Joaquin Valley Regional Continuing Education, Modesto.

- **West Nile virus in California**

Todd Walker: Kern County Environmental Health Department, Tehachapi.

MAY

- **West Nile virus surveillance in California**

Vicki Kramer: CDHS Public Health Grand Rounds, Sacramento.

- **West Nile virus in California**

Todd Walker: Kern County Environmental Health Department, California City.

JUNE

- **Rodent-borne diseases**

Larry Bronson: Lassen National Forest, Susanville.

- **West Nile virus in California**

Vicki Kramer: County Health Executives Association of California meeting, Sacramento.

- **California's West Nile virus surveillance program: An update**

Vicki Kramer: University of California Mosquito Conference, Davis.

- **A Public health risk: Mosquito production in BMPs**

Jonathan Kwan: Quarterly Epidemiologists Meeting, CDHS, Sacramento.

- **Hantavirus**

Todd Walker: Inyo National Forest Employee Responsibilities Training Meeting, Bishop.

- **Hantavirus, plague, and West Nile virus**

Todd Walker: Inyo National Forest Concessionaire Meeting, Bishop.

JULY

- **West Nile virus and pesticide use**

Marty Castro: Marin County Health Council, San Rafael.

- **Tick-borne diseases in California**

Anne Kjemtrup: Emerging Infectious Diseases Seminar, Center for Occupational and Environmental Health, Oakland.

- **West Nile virus activity in California: An overview**

Vicki Kramer: Agricultural Pest Control Advisory Committee meeting, Sacramento.

AUGUST

- **West Nile virus in the United States: Are we in panic mode yet?**
Curtis Fritz: Fremont-Rideout Consortium for Continuing Medical Education, Yuba City.
- **West Nile virus: A mostly fabricated and highly composited but reasonably accurate and fairly illustrative case study**
Curtis Fritz: Core Infectious Disease Emergency Readiness (CIDER) Summer Institute, Center for Infectious Disease Preparedness, University of California, Berkeley.
- **Forensic entomology and applications**
Al Hom: Santa Cruz Sheriff and Coroner's office, Watsonville.
- **Transmission risk of West Nile virus**
Renjie Hu: Hsi Lai Temple, Hacienda Heights.
- **West Nile virus in California**
Stan Husted: Public hearing on West Nile virus, Fresno.
- **A Public health risk: Mosquito production in BMPs**
Jonathan Kwan: Office of Water Programs and the California Department of Transportation, Sacramento.
- **Living with West Nile virus in California**
Marco Metzger: Safety and Health Education Seminar, Caltrans Office of Safety and Health, District 8, Hemet.
- **Living with West Nile virus in California**
Marco Metzger: Safety and Health Education Seminar, Caltrans Office of Safety and Health, District 8, San Bernardino.
- **Vector-borne diseases in California**
Jim Tucker: Groveland Ranger Station, Groveland.

SEPTEMBER

- **Wildlife diseases and worker safety**
Richard Davis: Pest Control Operators of Ventura County, Oxnard.
- **West Nile virus update**
Richard Davis: Ventura County Pollution Prevention Workshop, Ventura.
- **West Nile virus update**
Richard Davis: Santa Barbara County Pollution Prevention Workshop, Santa Maria.
- **West Nile virus—It's here!**
Stan Husted: Pollution Prevention for Medical Facilities Workshop, San Leandro.
- **West Nile virus in California: Are we in panic mode yet?**
Anne Kjemtrup: Medical Grand Rounds, San Mateo Medical Center, San Mateo.
- **West Nile virus prevention, surveillance, and control in California**
Vicki Kramer: Statewide Emergency Planning Committee Conference, Sacramento.
- **West Nile virus surveillance and response in California**
Marco Metzger: California Special Districts Association 35th Annual Conference, Indian Wells.
- **Update on West Nile virus**
Mark Novak: Pesticide Applicators Professional Association Seminar, Stockton.
- **Mosquito-borne diseases: Health issues and regulatory concerns**
Mark Novak: Pesticide Regulatory Education Program Course, Davis.

OCTOBER

- **Hantavirus risk reduction**
Larry Bronson: Lassen National Forest, Almanor Ranger District, Chester.
- **Tularemia and other tick-borne diseases in the San Francisco Bay area**
Peter Castro: West Coast Epidemiologists Conference, Tahoe City.

- **Rodent-borne diseases**

Richard Davis: California Environmental Health Association Southern Region Update Meeting, Oxnard.

- **West Nile virus in California**

Anne Kjemtrup: Medical Student Infectious Diseases Club, University of California, Davis.

- **West Nile virus in California: Are we in panic mode yet?**

Anne Kjemtrup: Environmental Health Directors Annual Meeting, Sacramento.

- **Hantavirus pulmonary syndrome in a university field researcher**

Jessica Levine: West Coast Epidemiologists Conference, Tahoe City.

- **Managing mosquitoes in stormwater treatment devices**

Marco Metzger: Construction Stormwater Compliance Workshop, The Building Industry Association of Southern California, Newport Beach.

- **Managing mosquitoes in stormwater treatment devices**

Marco Metzger: Construction Stormwater Compliance Workshop, The Building Industry Association of Southern California, Valencia.

- **Living with West Nile virus in California**

Marco Metzger: Safety and Health Education Seminar, Caltrans Office of Safety and Health, District 12, Irvine.

- **West Nile virus activity in California, 2004**

Mark Novak: MVCAC Northern San Joaquin Valley Regional Continuing Education, Modesto.

NOVEMBER

- **West Nile virus update**

Richard Davis: Pesticide Applicators Professional Association, Oxnard.

- **West Nile virus update**

Richard Davis: Pesticide Applicators Professional Association, Santa Maria.

- **Tales of an itinerant epidemiologist**

Curtis Fritz: Veterinary Epidemiology course, School of Veterinary Medicine, University of California, Davis.

- **What can I do with an M.P.H.?**

Stan Husted: Career Symposium, School of Public Health, University of California, Berkeley.

- **Tick-borne diseases in California**

Anne Kjemtrup: Medical Grand Rounds, San Mateo Medical Center, San Mateo.

- **Spiders of public health importance**

Marco Metzger: County of San Diego Vector Control Continuing Education Unit Training, San Diego.

- **Snakes and lizards of public health importance**

Marco Metzger: County of San Diego Vector Control Continuing Education Unit Training, San Diego.

- **Spiders of public health importance**

Marco Metzger: MVCAC Continuing Education Workshop, Culver City.

- **West Nile virus update**

Mark Novak: MVCAC Sacramento Valley Region Continuing Education, Elk Grove.

- **Update on West Nile virus activity in California**

Kerry Padgett: MVCAC Coastal Region Continuing Education Workshop, San Ramon.

DECEMBER

- **Wildlife diseases and worker safety**

Richard Davis: California Association of Pest Control Advisers, Santa Paula.

- **An overview of infectious disease surveillance and control in California**
Al Hom: California Institute of Integral Studies, San Francisco.
- **Hantavirus in California**
Vicki Kramer: University of California, Davis.
- **Hantavirus: Risk reduction at USFS facilities**
Jessica Levine: U.S. Forest Service Province Safety Committee meeting, Susanville.
- **Snakes and lizards of public health importance**
Marco Metzger: County of Riverside Environmental Services Annual Divisional Meeting, Riverside.
- **West Nile virus**
Kerry Padgett: Continuing Education for County of Santa Clara Division of Agriculture, San Martin.

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- Chomel BB, Kikuchi Y, Martenson JS, Roelke-Parker ME, Chang C, Kasten RW, Foley JE, Laudre J, Murphy K, Swift PK, **Kramer VL**, O'Brien SJ. Seroprevalence of *Bartonella* infection in American free-ranging and captive pumas (*Felis concolor*) and bobcats (*Lynx rufus*). *Veterinary Research* 2004; 35:233-241.
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- Hu R**, Murray H, Hess B, **Walker TW, Linthicum KJ**. Seasonal abundance of adult *Ixodes pacificus* in the San Jacinto Mountains, Riverside County. *Proceedings and Papers of the Seventy-Second Annual Conference of the Mosquito and Vector Control Association of California* 2004; 72:73-76.
- Hu R**, Spano R, Rood M, **Walker TW, Linthicum KJ**. Temporal distribution of adult *Ixodes pacificus* at Griffith Park, Los Angeles County. *Proceedings and Papers of the Seventy-Second Annual Conference of the Mosquito and Vector Control Association of California* 2004; 72:61-62.
- Hui LT, Castro MB**, Clover J, **Thompson MA, Husted S**. Summary of *Ixodes pacificus* surveillance and testing for *Borrelia burgdorferi* in California. *Proceedings and Papers of the Seventy-Second Annual Conference of the Mosquito and Vector Control Association of California* 2004; 72:77-83.
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